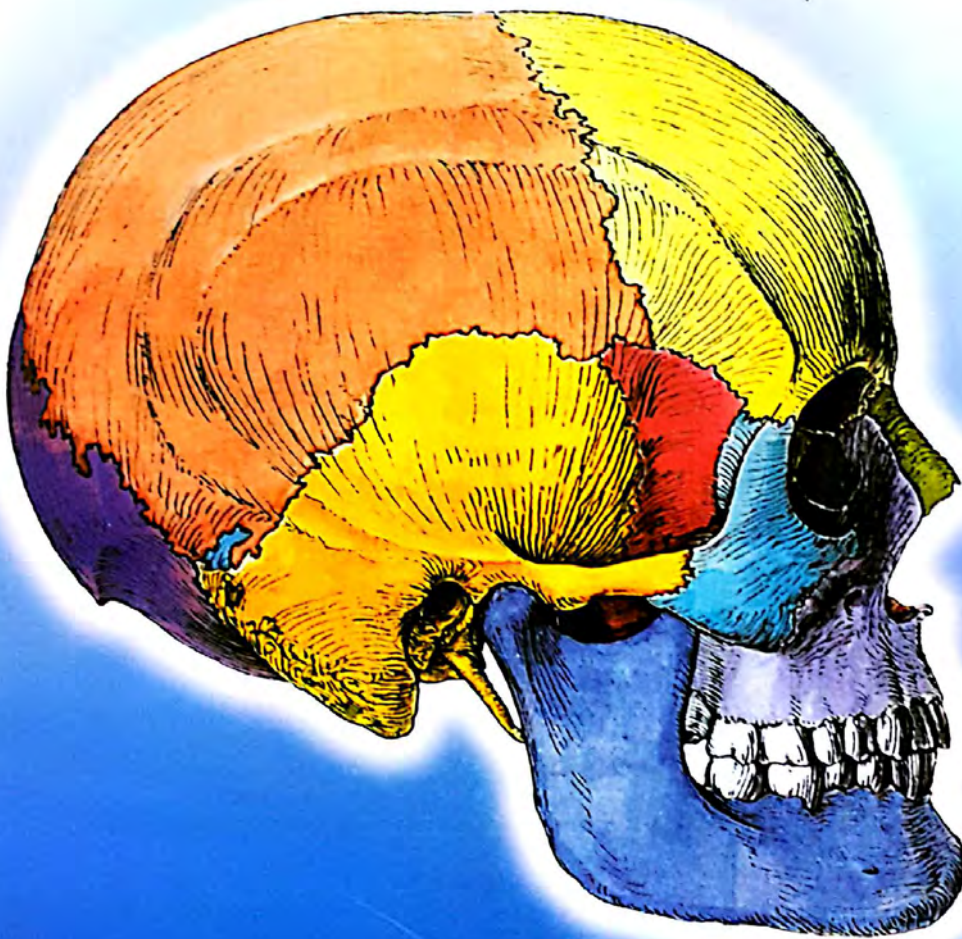


Anatomy Hand-out

HEAD & NECK



By

DR. SAMEH DOSS (Ph.D)

PROFESSOR OF ANATOMY

FACULTY OF MEDICINE, CAIRO UNIVERSITY

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THE SKULL

1

*The skull is the skeleton of the head.

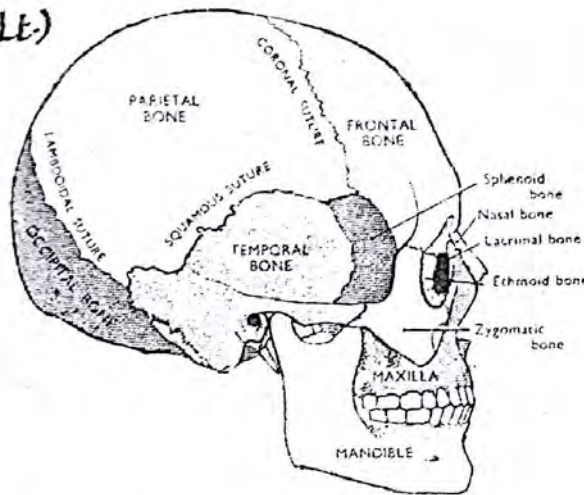
*Structure: it is formed of 22 bones:

- one movable bone: the mandible which articulates by synovial joint.
- 21 immovable bones articulating together by fibrous joints.

The 21 immovable bones include

8 paired bones (Rt. & Lt.)

- (1) parietal
- (2) temporal
- (3) zygomatic
- (4) lacrimal
- (5) maxillary
- (6) nasal
- (7) palatine
- (8) inferior concha



5 unpaired bones

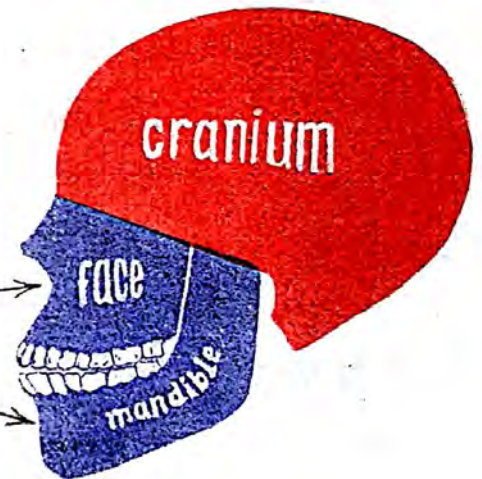
- (1) Frontal
- (2) ethmoid
- (3) sphenoid
- (4) occipital
- (5) vomer

*Parts of the skull:

(1) Cranium: the upper & post. part which encloses the brain.

(2) Facial Skeleton: is the ant. part of the skull which includes:

- (a) an upper fixed part.
- (b) lower movable part (the mandible).



*Different aspects of the skull

- (1) anterior aspect or Norma Frontalis.
- (2) superior aspect or Norma Verticalis.
- (3) lateral aspect or Norma Lateralis.
- (4) posterior aspect or Norma occipitalis.
- (5) inferior aspect or Norma Basalis.
- (6) the interior of the skull or Cranial Cavity is studied by removal of the skull cap.

I- THE NORMA VERTICALIS

2

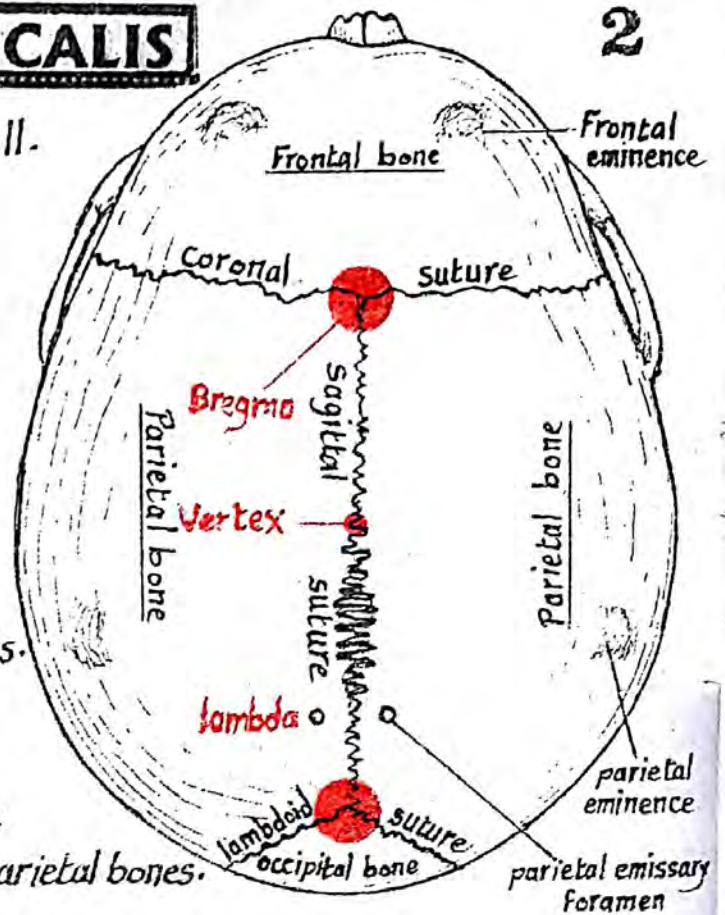
* It is the upper aspect (Vault) of the skull.

* Bones forming it : 4 bones :

- (1) Frontal bone : anteriorly.
- (2) 2 Parietal bones : on each side.
- (3) occipital bone : posteriorly.

* Sutures between the bones :

- (1) the Coronal suture : runs transversely between the frontal bone & the 2 parietal bones.
- (2) the Sagittal suture : runs in the median plane, connecting the 2 parietal bones.
- (3) the Lambdoid suture : runs between the occipital bone & the 2 parietal bones.

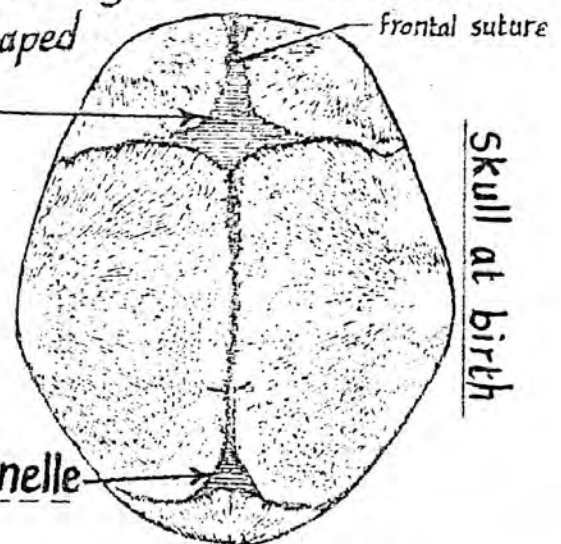


* Special Features

(1) The Bregma : it is the point of meeting between the sagittal & coronal sutures. - at birth, this area is occupied by a rhomboidal-shaped membrane called the Anterior Fontanelle which ossifies at the age of 18 months.

(2) Vertex : is the middle of the sagittal suture, it is the highest point of the skull.

(3) The Lambda : it is the point of meeting between the sagittal & lambdoid sutures. At birth, it is occupied by a small Δ membrane called Post-Fontanelle which ossifies at the age of 6 months.



(4) 2 Frontal eminences : the most convex parts of the frontal bone. They indicate the site of the ossification centres of frontal bone.

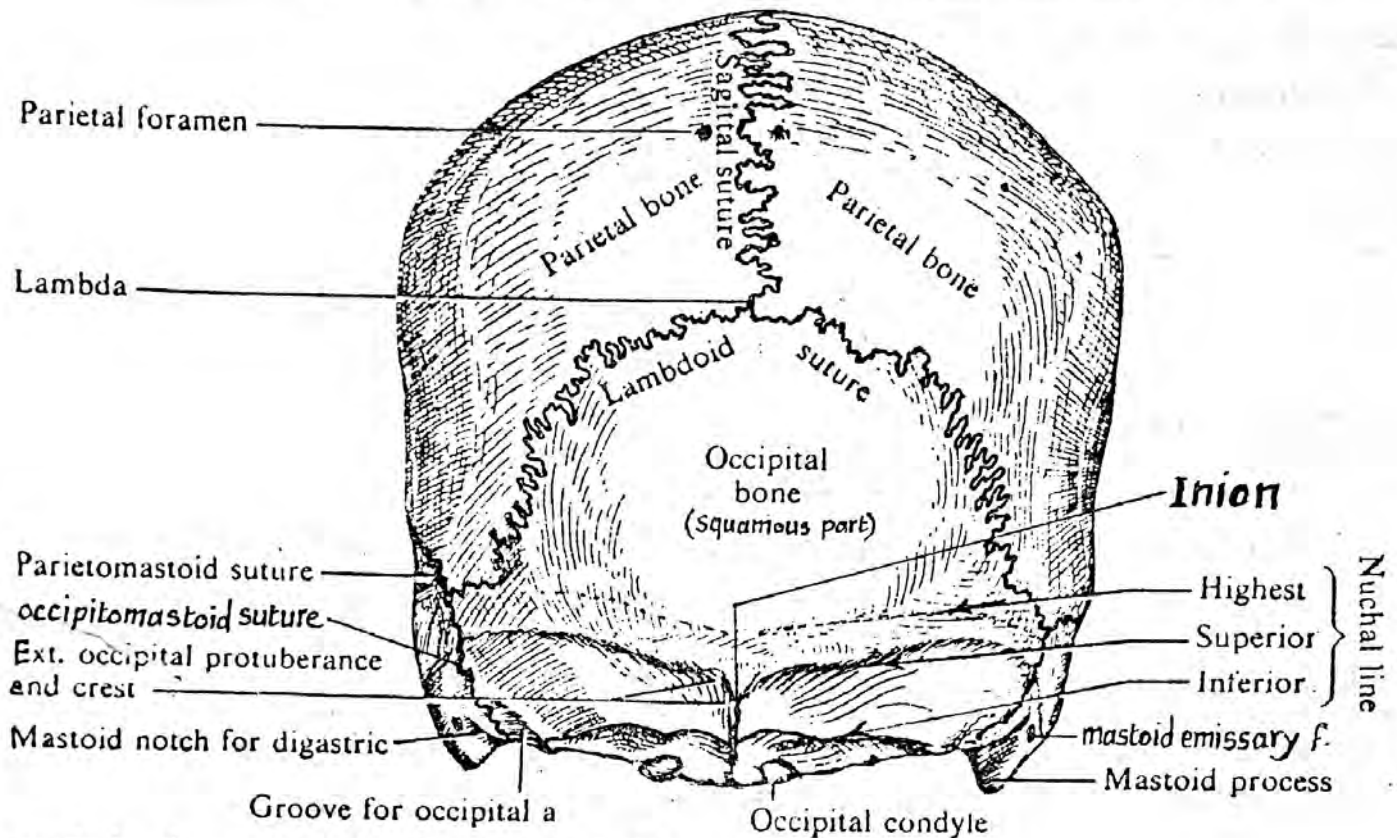
(5) 2 Parietal eminences : the most convex parts of the parietal bones. They indicate the site of the ossification centres of parietal bones.

(6) Parietal emissary foramen :

- one on each side of the sagittal suture, about 3-5 cm in front of the lambdoid suture.
- it transmits an emissary vein connecting the scalp veins with the sup. sagittal sinus.

THE NORMA OCCIPITALIS

3



* It is the post. aspect of the skull.

* Bones forming it :

- 2 parietal bones ----- on the sides & above.
- 2 mastoid temporal bones ----- on the sides & below.
- Squamous part of occipital bone ----- below & behind.

* Sutures between the bones :

- (1) Lambdoid suture : between the 2 parietal bones & the occipital bone.
- (2) occipito-mastoid suture : between the occipital & the mastoid temporal bones.

* Special Features :

(1) external occipital protuberance :

- lies midway between the lambda & the foramen magnum.
- its centre is called the inion.
- its upper part gives origin to trapezius muscle.
- its lower " " attachment to the upper part of the nuchal lig.

(2) External occipital Crest :

- extends from the external occipital protuberance to the post. border of the foramen magnum.
- it gives attachment to the base of the nuchal lig.

(3) Superior nuchal line :

- it is a bony ridge extending from the external occipital protuberance towards the mastoid process.
- its medial $\frac{1}{3}$ $\rightarrow$ gives origin to the trapezius m.
- its lateral $\frac{1}{3}$ $\rightarrow$ " insertion " Sternomastoid m.

(4) Inferior nuchal line :

- another bony ridge extending laterally from the middle of the external occipital crest, parallel to the sup. nuchal line & below it.

(5) Highest nuchal line :

- it is a faint ridge lying 1cm above the sup. nuchal line.
- its lateral part $\rightarrow$ origin of occipital belly of occipitofrontalis m.
- its medial part $\rightarrow$ attachment of the epicranial aponeurosis.

(6) Mastoid emissary Foramen :

- lies on the back of the mastoid process close to the occipitomastoid suture.
- it gives passage to an emissary vein (between the sigmoid sinus & the occipital veins).

THE NORMA FRONTALIS

* It is the anterior aspect of the skull.

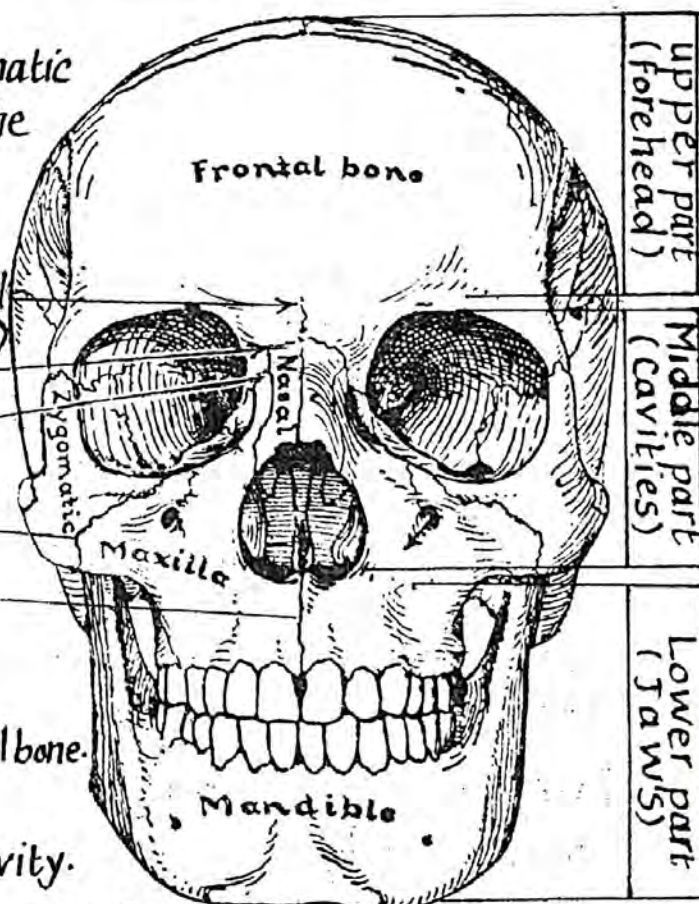
* Bones forming it: Frontal bone, 2 zygomatic bones, 2 maxillary bones (uniting to form the upper jaw) & the mandible (lower jaw).

* Sutures between the bones

- (1) Metopic suture: between the 2 halves of the frontal bone (present in 9% of people only)
- (2) Frontonasal suture
- (3) Frontomaxillary suture
- (4) Zygomaticomaxillary suture
- (5) intermaxillary suture

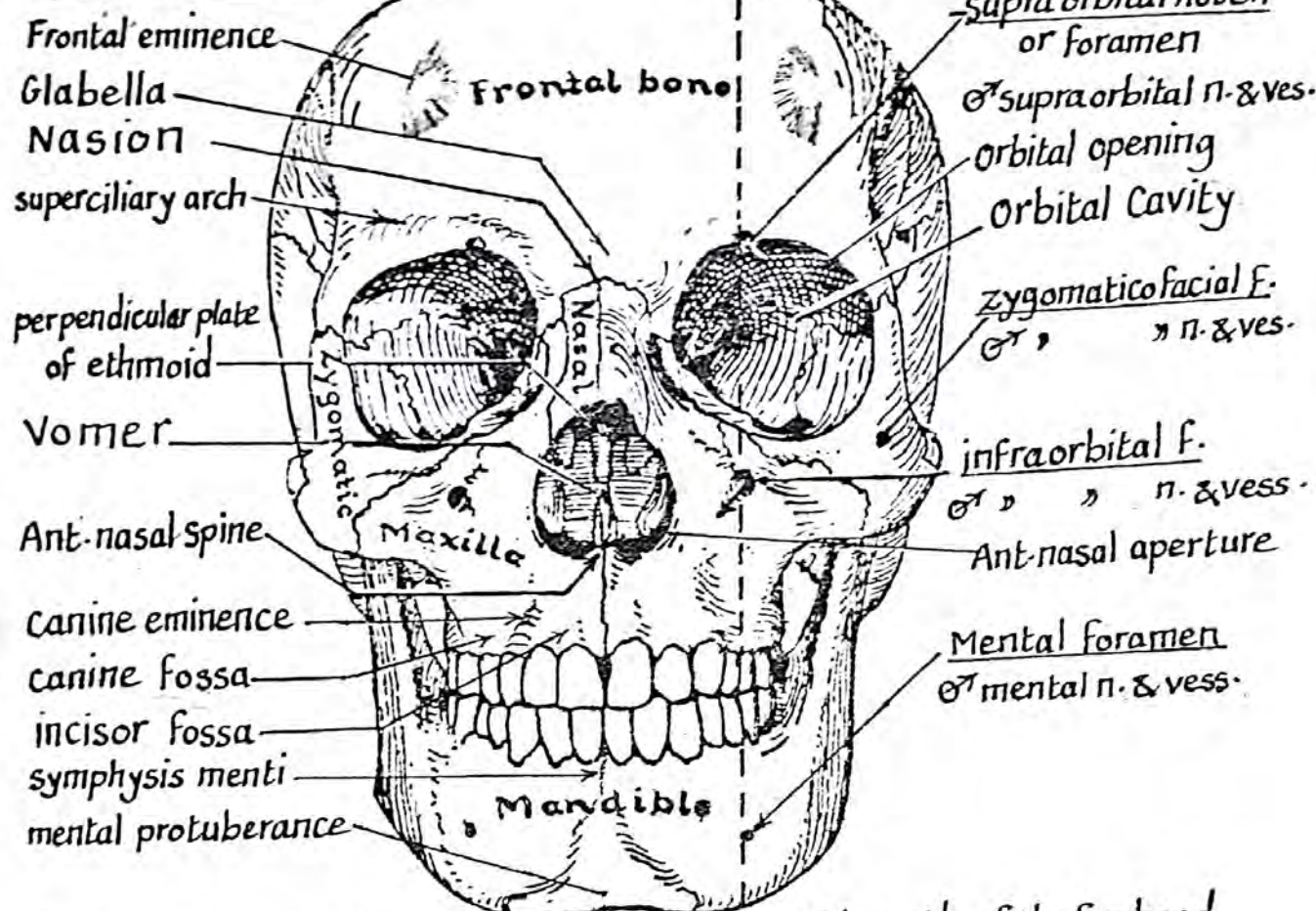
* Parts of the norma frontalis :

- (1) upper part or forehead: Formed by the frontal bone.
- (2) Middle part containing the 3 cavities: 2 orbital cavities & nasal cavity.
- (3) Lower part: Formed by the upper & lower jaws.



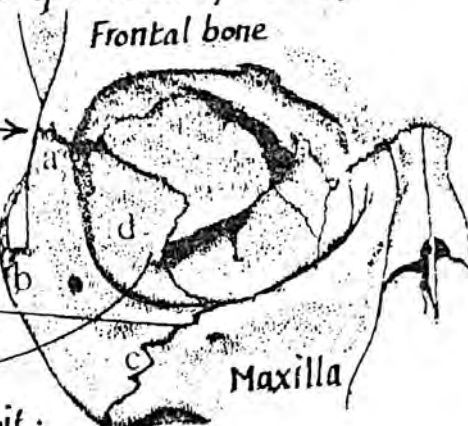
Special Features:

Foramina 5



- 1) Frontal eminences: the most prominent areas on either side of the forehead.
- 2) Superciliary arches: elevated arched ridges just above the medial parts of the sup-orbital margins. They are more prominent in males.
- 3) Glabella: a median elevation between the 2 superciliary arches above the root of nose.
- (4) Nasion: the point of meeting of frontonasal & internasal sutures.
- (5) Supra-orbital notch (or foramen): lies at the junction of the med. $\frac{1}{3}$ & lat. $\frac{2}{3}$ of the sup-orbital margin. It transmits supraorbital nerve & vessels.
- (6) the Nasal bones: they form the bridge of the nose. They articulate above with the frontal bone (frontonasal suture) & laterally, with the frontal process of maxilla. They articulate together in the middle line (internasal suture). Their lower borders form the upper boundary of the ant-nasal aperture (piriform aperture).
- (7) the Zygomatic bones: each bone has:

- (a) Frontal process: articulating with the frontal bone
- (b) temporal " : articulating with zygomatic process of temporal bone to form the zygomatic arch
- (c) maxillary " : articulating with maxilla
- (d) orbital plate: sharing in formation of the lat-wall & the floor of the orbital cavity
- (e) zygomaticofacial F.: close to the inferolateral angle of the orbit.

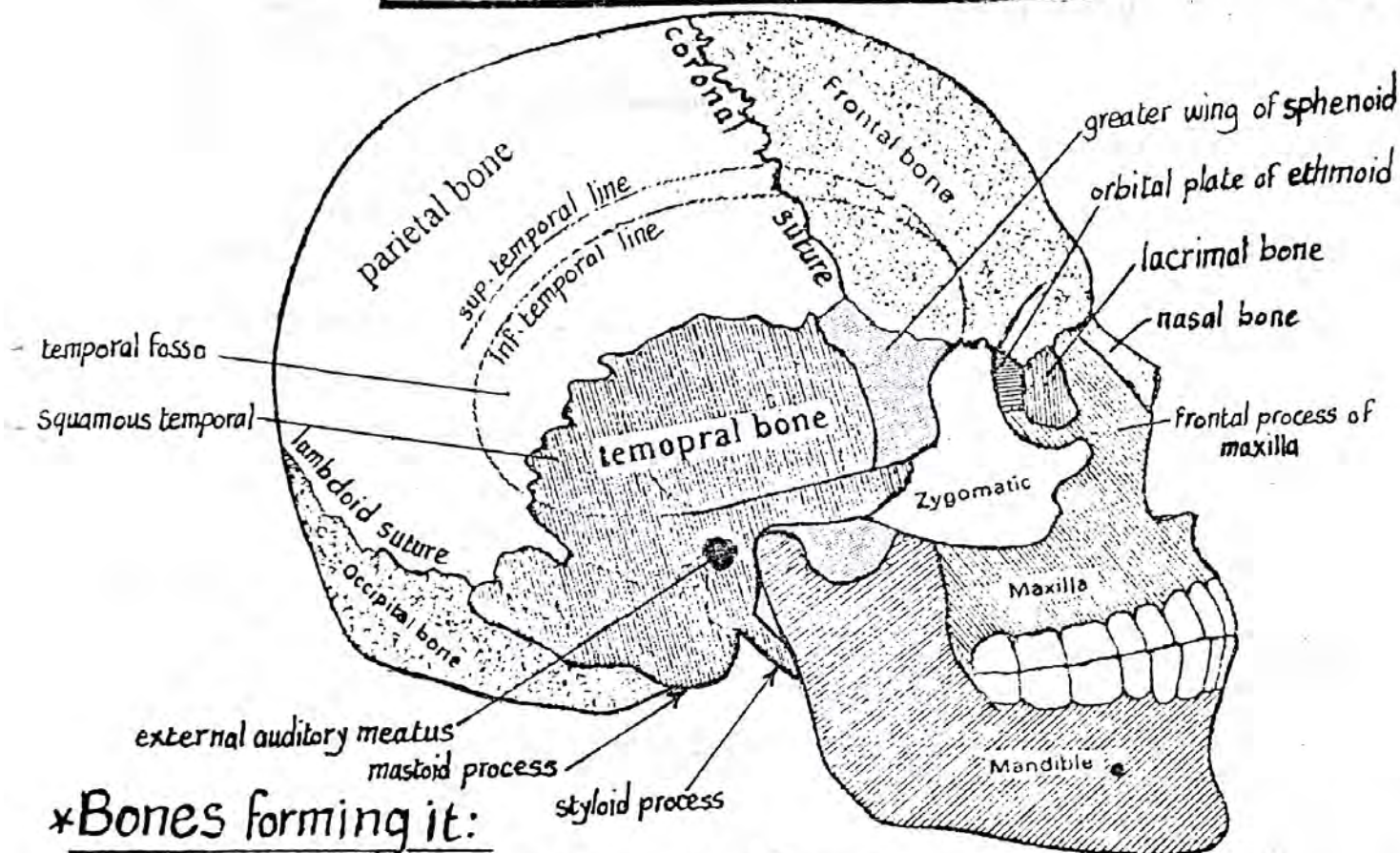


6

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- Diagram illustrating the lateral view of a human mandible (lower jawbone). The diagram is labeled with the following anatomical features:
- 6** (Top right corner)
 - infraorbital f.** (infraorbital foramen)
 - orbital surface**
 - posterior surface**
 - zygomatic process**
 - alveolar process**
 - Canine fossa**
 - Canine eminence**
 - incisor fossa**
 - facial surface**
 - Frontal Process**

A line drawing of a human skull in profile, facing left. Labels with leader lines point to the Orbit, Zygoma, Maxilla, and Mandible.

- (a) supra-orbital notch or foramen } lie along vertical line passing between the 2 premolar
(b) infra-orbital foramen } teeth & transmit nerves and vessels indicated by their
(c) mental " } names (terminal brs. of trigeminal n.).
(d) zygomaticofacial f. : in the zygomatic bone of zygomaticofacial n. & vessels.



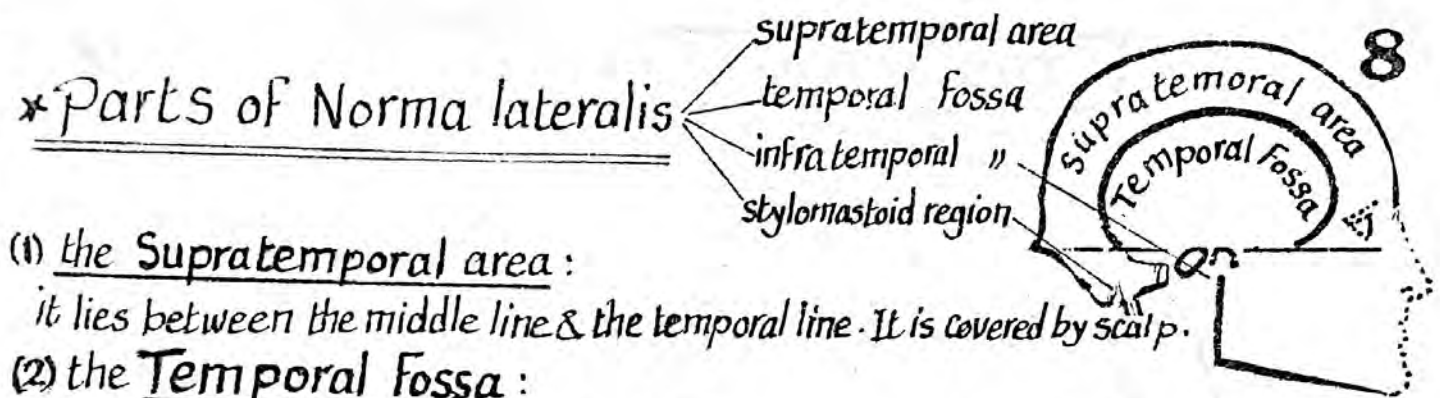
*Bones forming it:

- Superiorly : nasal, frontal & parietal bones
- inferiorly : maxilla, zygomatic, greater wing of sphenoid, squamous & mastoid parts of temporal bone & squamous part of the occipital bone.

*Special Features :

- (1) Temporal line(s) : starts anteriorly at the zygomatic process of the frontal bone. It soon divides into :
 - (a) Superior temporal line : fades away as it passes backwards. It gives attachment to (a) epicranial aponeurosis (b) temporal fascia.
 - (b) inferior temporal line : curves backwards then downwards & forwards to become continuous with the supramastoid crest. It gives origin to temporalis muscle.
- (2) Supramastoid crest : it is the distinct lower end of the temporal line as it passes above the mastoid process to reach the post. end of the zygomatic process of temporal bone.
- (3) Zygomatic arch : it is a bony bridge formed of :
 - (a) the temporal process of the zygomatic bone (anteriorly) &
 - (b) the zygomatic " " " " temporal bone (posteriorly).
 - Its lower border & inner surface give origin to the masseter m.

* Parts of Norma lateralis



(1) the Supratemporal area :

it lies between the middle line & the temporal line. It is covered by scalp.

(2) the Temporal Fossa :

- Boundaries : • sup. temporal line-----above & behind .

• zygomatic arch-----below .

• frontal process of zygomatic bone----anteriorly .

- Structures attached : the 2 superficial muscles of mastication :

(a) temporalis m. arises from the floor of the temporal fossa .

(b) masseter m. arises from the lower border & inner surface of zygomatic arch.

(3) Infratemporal fossa :

- it is the space below the temporal fossa & behind maxilla.

• Boundaries :

- anteriorly : post. surface of maxilla

- medially : lateral pterygoid plate

- laterally : ramus & coronoid process of mandible

- posteriorly : styloid & mastoid processes

• Communications : it communicates with:

(1) orbit through the inferior orbital fissure.

(2) temporal fossa through the gap deep to the zygomatic arch.

(3) pterygopalatine fossa through the pterygomaxillary fissure.

(4) middle cranial fossa " " foramen ovale & foramen spinosum.

• Contents of the infratemporal fossa :

(1) Muscles : - the 2 deep muscles of mastications

med. pterygoid m.

lat. pterygoid m.

(2) Ligament : the sphenomandibular lig.

(3) Vessels : (a) 1st & 2nd parts of maxillary artery & their branches .

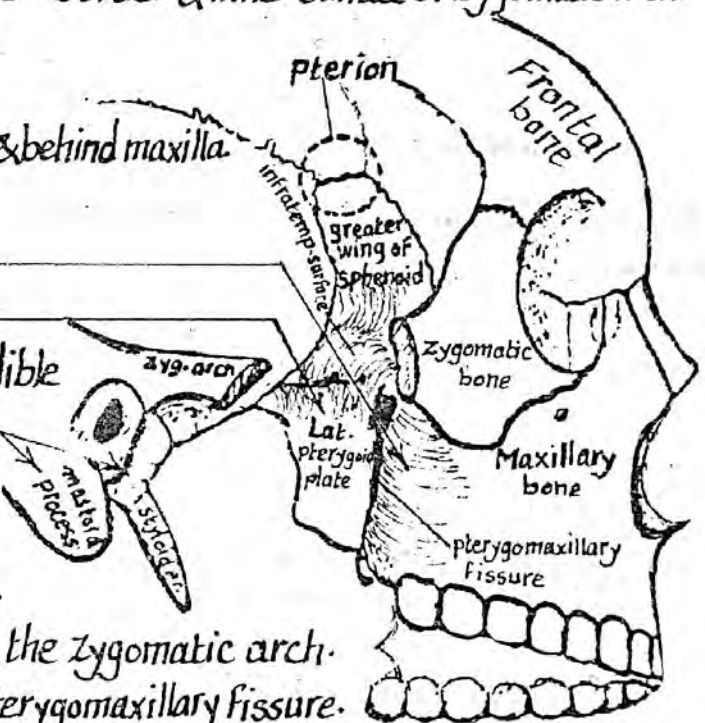
(b) pterygoid venous plexus & maxillary vein.

(4) Nerves : (a) mandibular n. & its brs.

(b) small part of maxillary n.

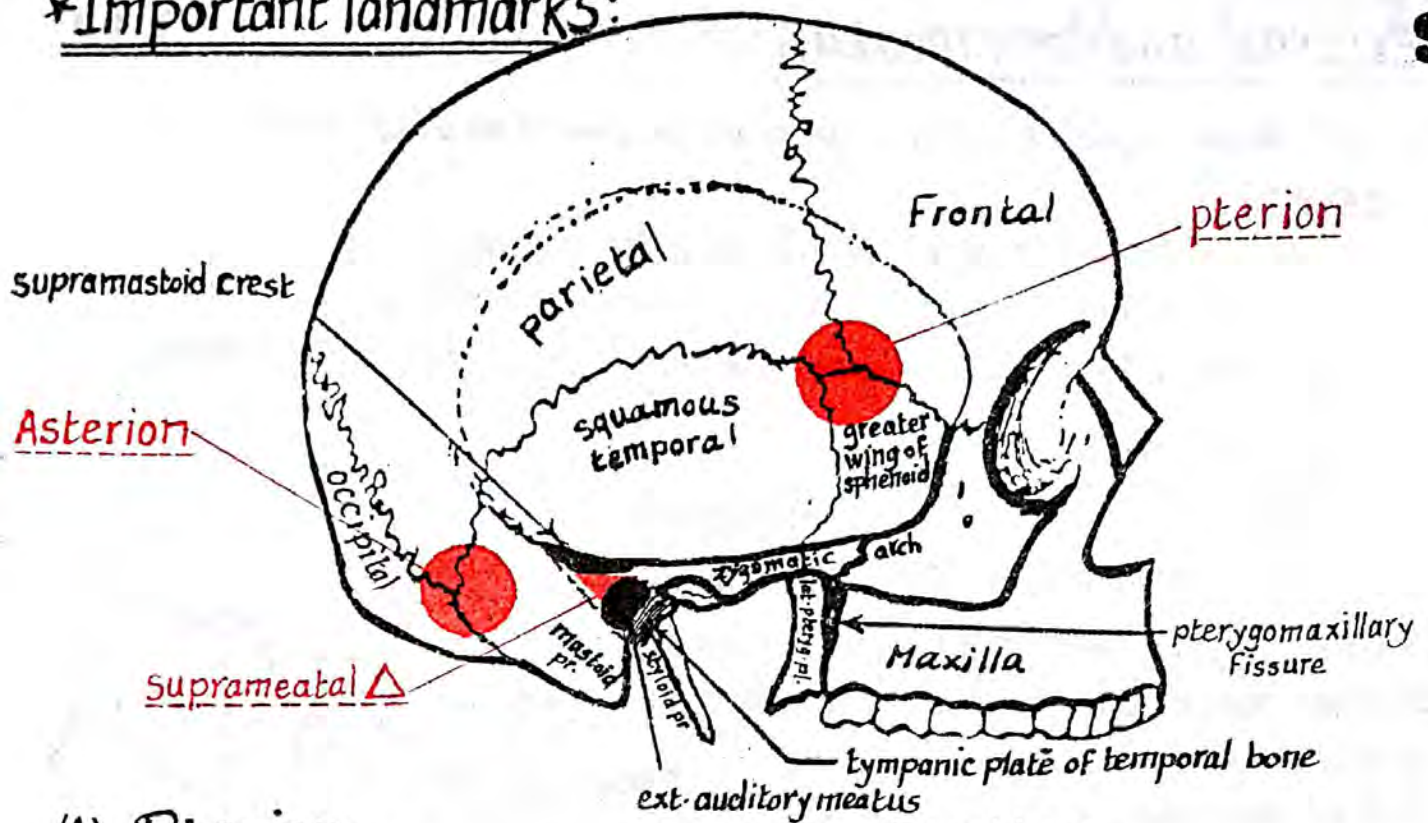
(c) chorda tympani .

(d) otic ganglion .



*Important landmarks:

9



(1) Pterion :

- it is the area of meeting of 4 bones :
 - Frontal bone
 - parietal "
 - squamous temporal bone
 - greater wing of sphenoid
- At birth, the pterion is occupied by a membrane called the anterolateral (sphenoidal) fontanelle which ossifies at the age of 3 months (see page 36).
- In the adult, the centre of the pterion lies about $1\frac{1}{2}$ " behind the fronto zygomatic suture & $1\frac{1}{2}$ " above the midpoint of the zygomatic arch.
- importance : the Centre of the pterion is related internally to ant. br. of middle meningeal a.

(2) Asterion :

- it is the point of meeting of 3 bones :
 - (1) parietal bone
 - (2) occipital "
 - (3) mastoid temporal bone
- At birth, the asterion is occupied by a membrane called the anterolateral (mastoid) fontanelle which ossifies at the age of 3 months (see page 36).
- In the adult, the asterion is related internally to the highest point of transverse sinus.

(3) Supra-meatal triangle :

- it is a triangular area just above & behind the external auditory meatus.
- Boundaries :
 - (1) supramastoid crest ----- superiorly
 - (2) posterosuperior margin of the ext. aud. meatus ----- anteriorly
 - (3) tangent line to the post. margin of the meatus ----- posteriorly
- Surgical importance :
 - (1) it forms the lat. wall of the mastoid (tympanic) antrum.
 - (2) a drill hole above the supra-meatal Δ will enter the middle cranial fossa.

(4) External auditory meatus:

10

- lies just below the post. root of the zygomatic process of temporal bone.
- it is bounded:
 - a - posterosuperiorly by squamous temporal bone.
 - b - anteroinferiorly by tympanic part of temporal bone.
- its rough margin gives attachment to the cartilagenous part of the meatus

(5) Mastoid process:

- it is a nipple-like process felt subcutaneously deep to the lobule of the ear.
- its outer surface gives insertion to 3 muscles arranged from before backwards as follows:
 - (a) Sternomastoid m.
 - (b) Splenius Capitis m.
 - (c) Longissimus Capitis m.

(6) Styloid process:

- it is a thin long projection from temporal bone anteromed. to mastoid pr.
- its base is partly ensheathed by the tympanic plate.
- it gives attachment to 2 ligaments & 3 muscles (page 21).

(7) Pterygo-maxillary fissure:

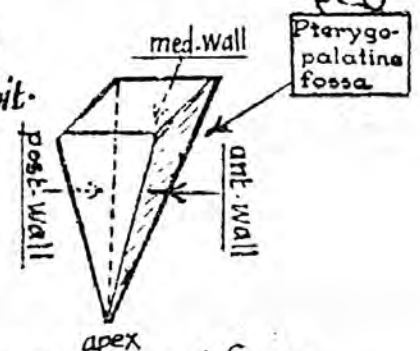
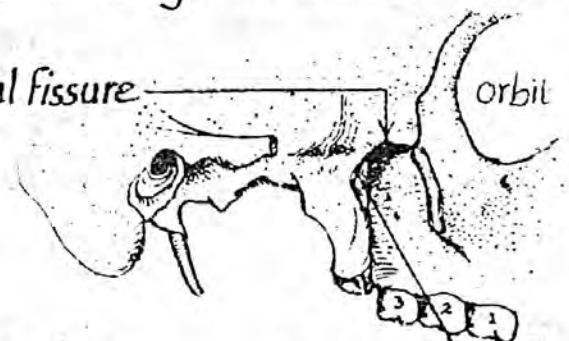
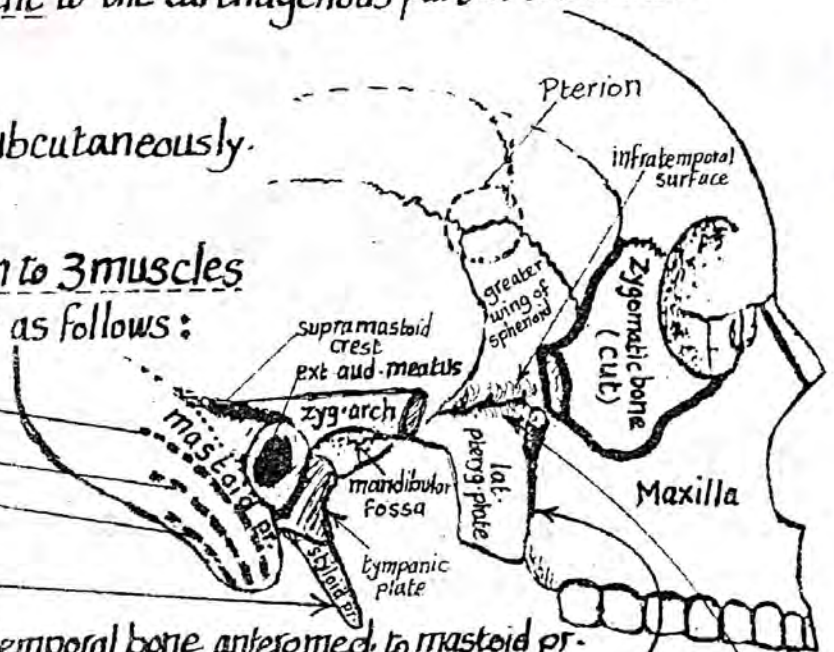
- it is a vertical slit between the upper parts of:
 - pterygoid pr. posteriorly
 - maxilla anteriorly.
- it leads medially into the pterygopalatine fossa (Connecting it with the infratemporal fossa laterally).
- its upper end is continuous with the inferior orbital fissure which leads to the orbit.
- it transmits maxillary n. & maxillary a.

(8) Pterygo-palatine fossa:

- * it is a small inverted pyramidal-shaped space lying med. to the pterygomaxillary fissure & behind the apex of orbit.

* Boundaries:

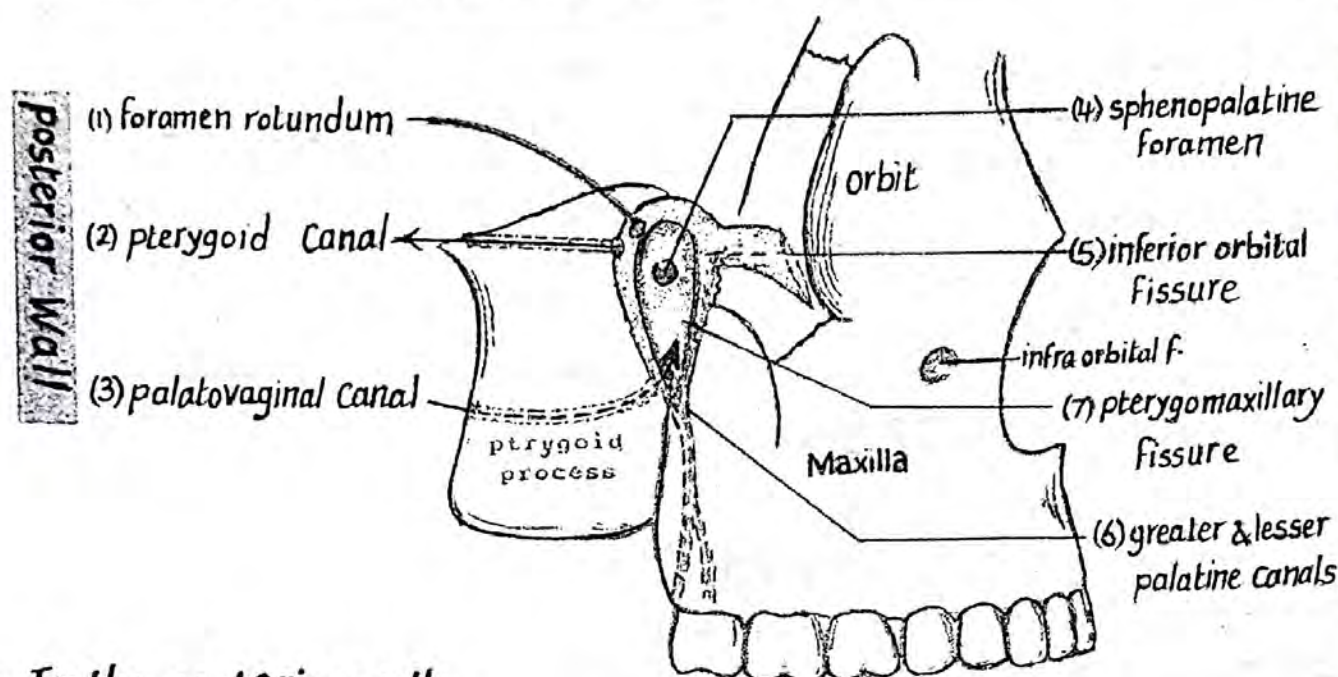
- ant. wall: post. surface of maxilla.
- post. wall: pterygoid process of sphenoid bone.
- med. wall: perpendicular plate of the palatine bone.
- laterally: pterygomaxillary fissure communicates it with the infratemporal fossa.



* Contents of the pterygopalatine fossa:

- (1) terminal part of maxillary artery.
- (2) maxillary nerve.
- (3) sphenopalatine ganglion suspended from the nerve.

* Foramina & fissures opening in the pterygopalatine fossa:



* In the posterior wall:

- (1) f. rotundum: transmitting maxillary n. from the cranial cavity to the fossa.
- (2) pterygoid canal: » the nerve and artery of the pterygoid canal.
- (3) palatovaginal canal: » the pharyngeal branch of the sphenopalatine ganglion to the pharynx.

* In the medial wall:

- (4) the sphenopalatine f.: transmitting the short and long sphenopalatine nerves to the nasal cavity.

* In the anterior wall:

- (5) the inf. orbital fissure: connecting the fossa with the orbit.

* In the apex (meeting of the ant. & post. walls):

- (6) greater palatine and lesser palatine canals: transmitting the greater and lesser palatine nerve and vessels to the palate.

* In the lateral wall:

- (7) pterygomaxillary fissure: connecting the pterygopalatine fossa to the infratemporal fossa and transmitting maxillary n. and a.

NORMA BASALIS EXTERNA

12

* It is the outer surface of the skull base.

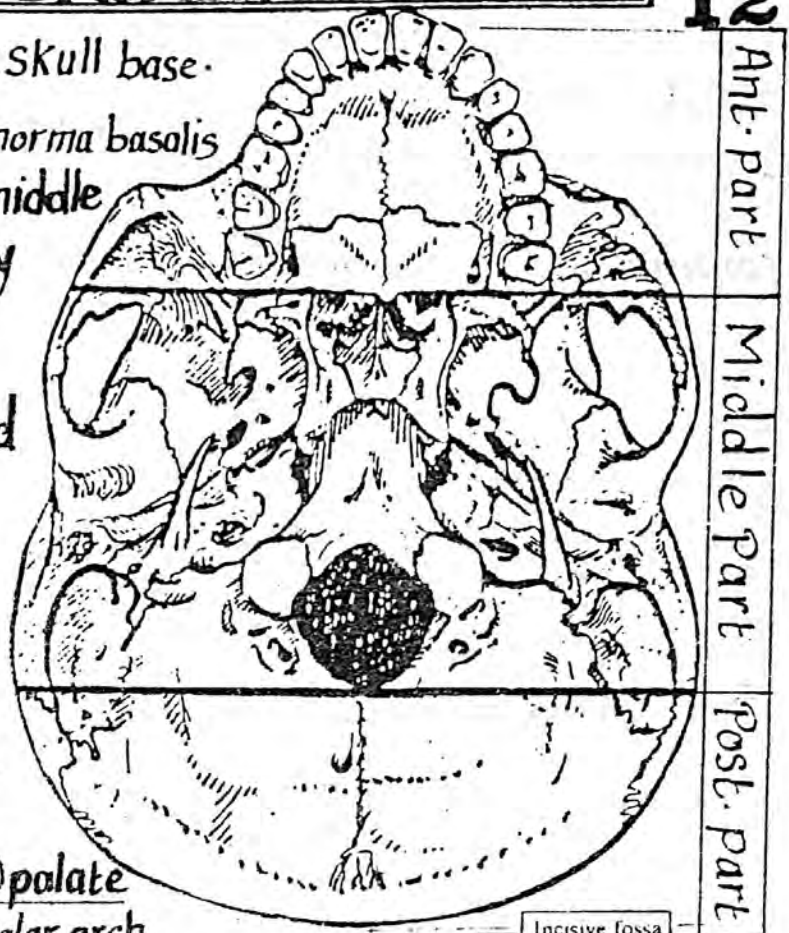
* For descriptive purposes, the norma basalis externa is divided into ant., middle & post. parts by 2 imaginary transverse lines :

(1) ant-transverse line :

along the post. border of the hard palate.

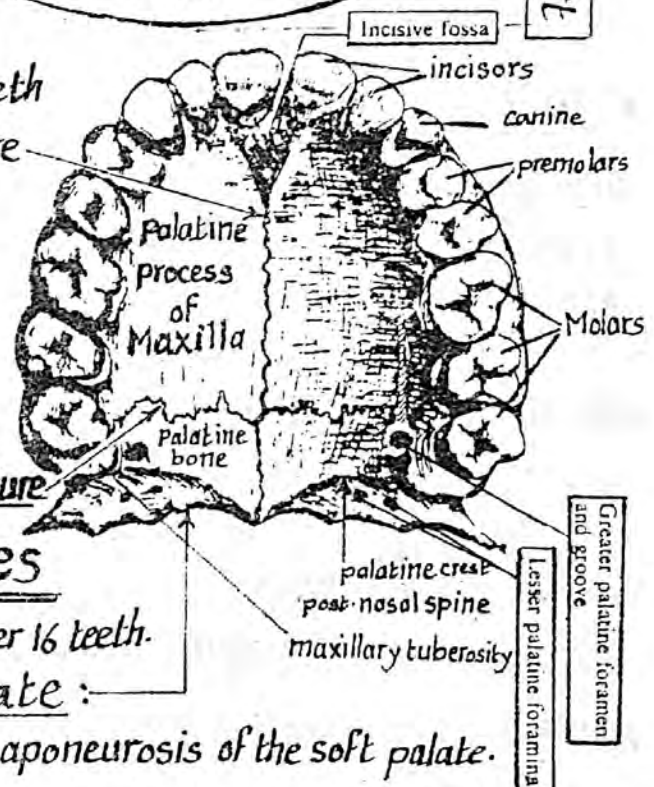
(2) post-transverse line :

passing through the post. border of the foramen magnum.



1 - ANT. PART OF NORMA BASALIS EXTERNA :

- it is formed by the hard (bony) palate which is bounded within the alveolar arch carrying sockets for the roots of the upper teeth
- it is divided by the median palatine suture into right & left halves.
- Each half is formed by 2 parts :
 - (1) ant. 3/4 formed by palatine pr. of maxilla.
 - (2) post 1/4 » » the horizontal plate of the palatine bone.
- the 2 parts unite at the palatomaxillary suture



Particular Features

(1) Alveolar arch : carries the sockets for the upper 16 teeth.

(2) Posterior Free border of the hard palate :

is sharp & gives attachment to the palatine aponeurosis of the soft palate.

(3) Post-nasal Spine : is a sharp median projection the post. border of the hard palate. It gives origin to a muscle of the soft palate called *musculus uvulae*.

(4) Palatine crest : a transverse ridge behind the lat. part of the palato-maxillary suture opposite to the last molar tooth.

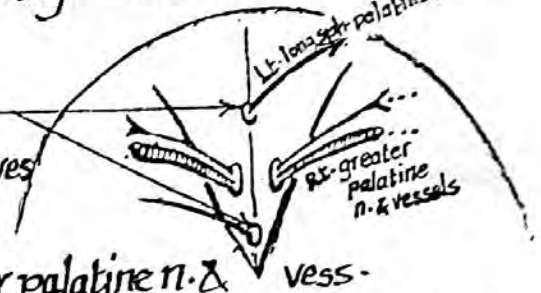
(5) Maxillary Tuberosity : lies at the post-end of the alveolar arch of maxilla **13**
It gives origin to the superficial head of the med. pterygoid m.

(6) Foramina in the ant. part of the base

(a) Incisive fossa : at the ant. part of the intermaxillary suture behind the incisors.

It contains 4 small foramina:

- 2 median foramina (ant. & post.)
transmitting Lt. & Rt. long sphenopalatine nerves
- 2 lateral foramina (Rt. & Lt.) :
transmitting the terminal brs. of Rt. & Lt. greater palatine n. & vess.



(b) greater palatine foramen : lies med. to the last molar socket, in front of the palatine crest. It is the lower end of the greater palatine canal.

- it transmits the greater palatine n. & vessels which pass forwards along a groove on the bony palate (supplying its mucous membrane).

(c) Lesser palatine foramina (usually 2) : lie on the pyramidal process of palatine bone behind the palatine crest. They transmit lesser palatine n. & vessels.

2- MIDDLE PART OF NORMA BASALIS EXTERNA

* Bones forming it :

- anteriorly in the middle : vomer, body of sphenoid

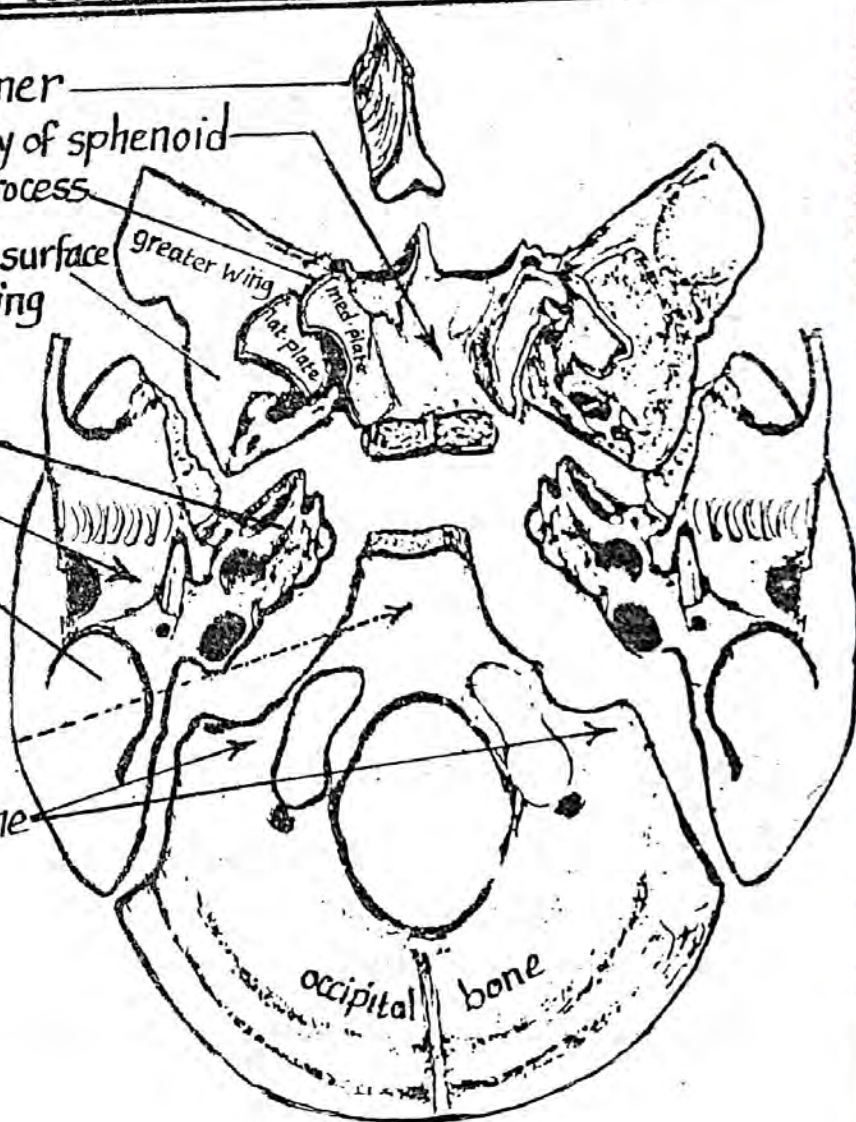
- anterolaterally (sphenoid bone) : pterygoid process, infratemporal surface of greater wing

→ Posterolaterally :

- petrous part of temporal bone
- tympanic " " " "
- mastoid " " " "

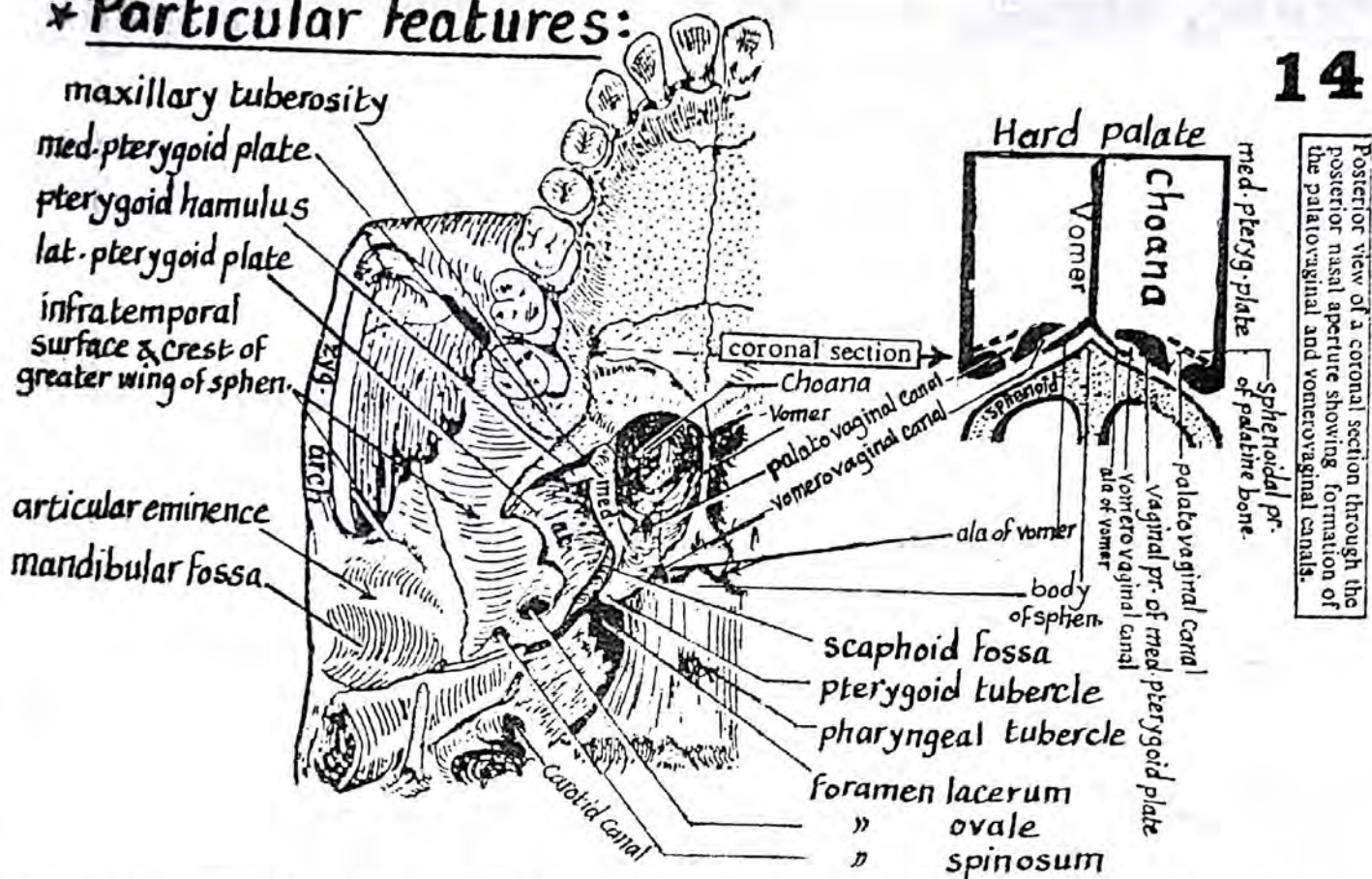
- Posteriorly in the middle

- basilar part of the occipital bone
- 2 lat. parts of the occipital bone



* Particular Features:

14



(1) Post-nasal openings (Choanae) : separated from each other by the Vomer

(2) The Vomer :

- a median vertical bony plate intervening between the 2 post-nasal opening.
- the ala of vomer is the upper expanded part, articulating with the body of sphenoid.
- lat. to the ala there is the vaginal process of med. pterygoid plate which is separated from the ala of vomer by the **Vomero-Vaginal Canal**.

(3) Pterygoid process of sphenoid (lat. to the choana) :

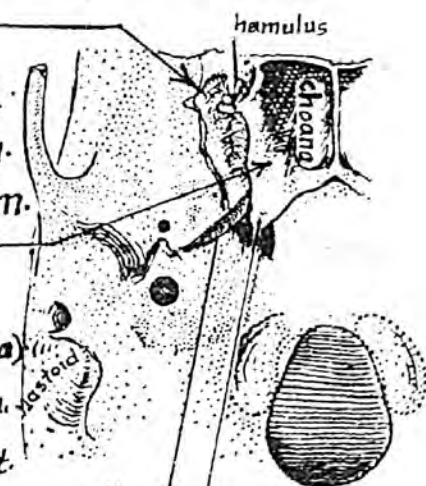
- anteriorly, it is separated from maxilla by the pterygomaxillary fissure.
- posteriorly, it presents med. & lat. pterygoid plates separated by pterygoid fossa :

(A) Lateral pterygoid plate :

- it forms the lat. boundary of the infratemporal fossa.
- its lat. surface gives origin to lower head of lat. pterygoid m.
- its med. " " " " deep head of med pterygoid m.

(B) Med. pterygoid plate :

- it forms the lat. boundary of the post-nasal opening (choana)
- its post-border gives attachment to the pharyngeobasilar fascia & is related to the pharyngeo-tympanic tube in the upper part.
- the upper end of the post-border divides into
 - scaphoid fossa laterally
 - pterygoid tubercle medially.



- the lower end of the post. border end in pterygoid hamulus (hook) which is related laterally to the tendon of tensor palati m.
- the pterygoid hamulus gives attachment to :
 - a - upper end of pterygomandibular ligament.
 - b - origin of upper fibres of sup. constrictor m. of pharynx.

(C) Pterygoid fossa : is a V-shaped space between the med. & lat. pterygoid plates

- N.B: (1) the scaphoid fossa at upper end of the med. pterygoid plate.

gives origin to tensor palati m.

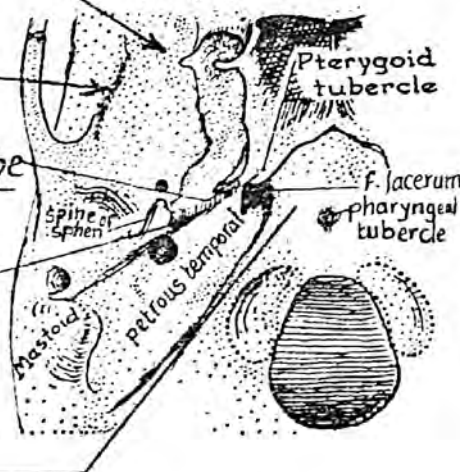
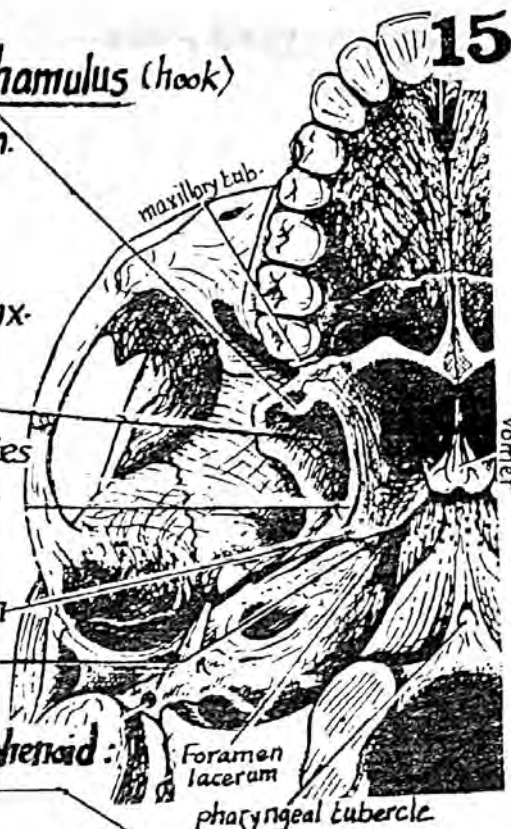
(2) the pterygoid tubercle lies in front of Foramen lacerum

Above the tubercle lies the post-end of pterygoid canal

(4) Infra temporal Surface of greater wing of sphenoid :

- gives origin to the upper head of lat. pterygoid m.
- it is bounded laterally by infra temporal crest which also gives origin to lat. pterygoid m.
- it is bounded medially by the groove for pharyngotympanic tube (between the greater wing & the petrous temporal bone)
- The groove leads backwards to the bony opening of the tube
- the infra temporal surface shows

- (1) spine of sphenoid
- (2) foramen ovale
- (3) " spinosum



(5) Basilar part of occipital bone :

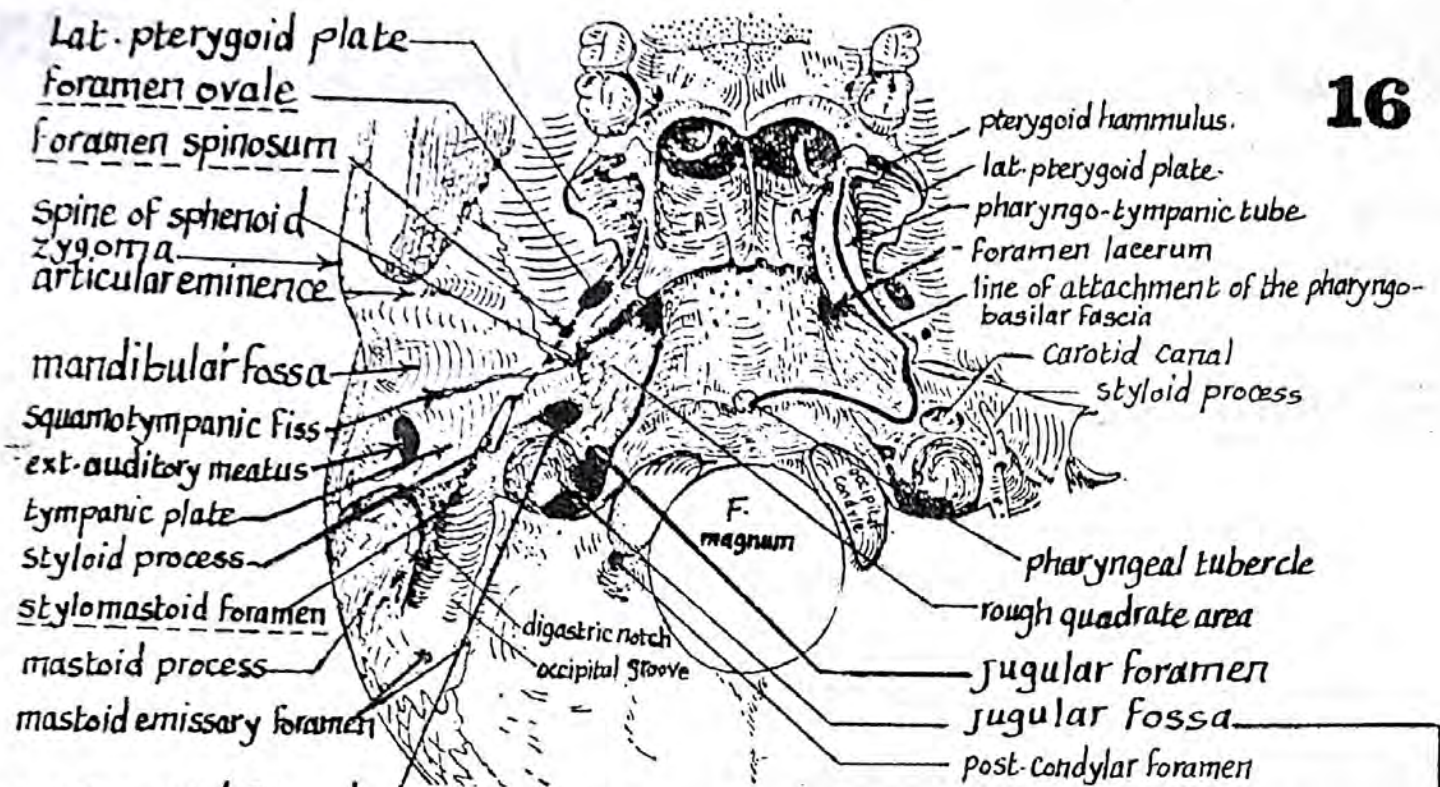
- articulates anteriorly with the body of sphenoid (fusion occurs at the age of 18-25 years). The line of fusion lies opposite the 2 sphenoidal spines.
- The pharyngeal tubercle : a median elevation in the basilar part of occipital bone 1 cm in front of the f. magnum. It receives insertion of the median raphe of pharynx.

(6) Petrous part of the Temporal bone :

- it is wedged between the greater wing of sphenoid & basilar part of occipital bone.
- it shows the following features :

(a) Foramen lacerum : lies between : (1) the apex of the petrous temporal bone (posteriorly) (2) the pterygoid process (anteriorly) (3) the basilar part of the occipital bone (medially) : See page 19 for structures passing.

(b) A rough quadrate area behind the apex of the petrous temporal (between f. lacerum anteriorly & carotid canal posteriorly). It gives origin to levator palati m.



(c) Carotid Canal: lies behind the rough quadrate area of petrous temporal bone.

(d) Jugular Foramen: lies posterior to the carotid canal (between the petrous temporal bone & occipital bone). Its post. end is hollowed out to form the jugular fossa.
N.B: the Rt. jugular F. is larger than the Lt. one (see page 135).

(7) The Styloid & mastoid parts of temporal bone:

(a) Styloid process: a pointed process lat. to the jugular F. & in front of mastoid process.

(b) Mastoid process: a nipple-shaped process behind the styloid process

- mastoid notch: lies med. to the process & gives origin to post. belly of digastric m.
- occipital groove: lies medial to the notch & lodges the occipital artery.

(c) Stylomastoid F.: lies between the styloid & mastoid processes (see p. 18).

N.B: **3 foramina** (F. ovale, spinosum & stylomastoid F.) & **3 processes** (spine of sphenoid, styloid pr. & mastoid pr.) are arranged along an imaginary line extending from the lat. pterygoid plate to the mastoid process.

(8) Articular surfaces of norma basalis externa:

(a) Mandibular fossa: a concave depression in the squamous part of the temporal bone. It articulates with the head of mandible in the temporomandib. joint.

(b) Articular Eminence: an elevation in front of the mandibular fossa. It is continuous with the post. root of the zygomatic pr. of temporal bone. It gives attachment to the lat. lig. of the temporo-mandibular joint (T.M.J).

N.B: the Tympanic plate of temporal bone lies behind the articular fossa & separated from it by the squamotympanic fissure (p. 21) **17**

(C) Occipital Condyles: 2 kidney-shaped articular facets situated on each side of the ant. part of the foramen magnum. They articulate with the sup. articular facets of the atlas vertebra (atlanto-occipital joint).

(9) Foramina related to the occipital Condyles:

- (a) Foramen magnum: it is the largest foramen of the skull & is oval in shape. It opens upwards into the post. cranial fossa & downwards into the verteb. canal.
- (b) Ant. Condylar F. (Hypoglossal Canal): lies anterosuperior to the occipital condyle (one on each side).
- (c) Condylar fossa: a depression behind the occipital condyle. It may be perforated by a Post-condylar foramen (transmitting an emissary v.).

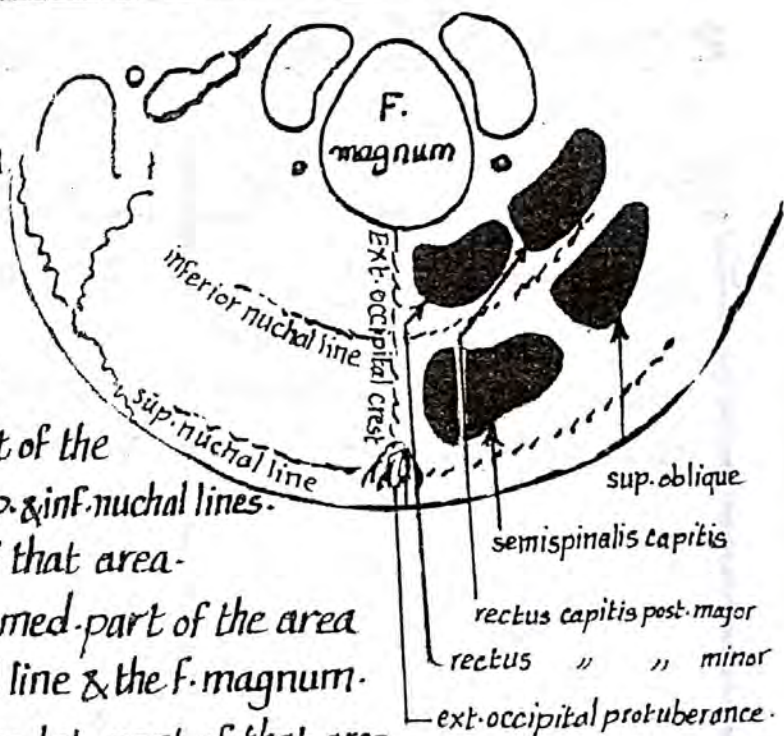
3- POST. PART OF NORMA BASALIS EXTERNA

(A) It shows the following features:

- (1) ext. occipital protuberance
 - (2) " " crest
 - (3) sup. nuchal line
 - (4) inf. " "
- } see norma occipitalis p. 3, 4

(B) It gives insertions to 4 muscles:

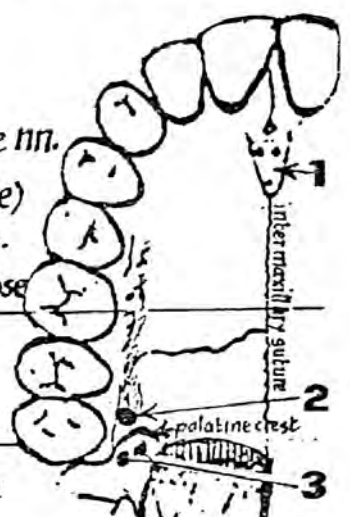
- (1) Semispinalis Capitis: into the med. part of the area between the sup. & inf. nuchal lines.
- (2) Superior oblique m.: to the lat. part of that area.
- (3) rectus Capitis post. minor: into the med. part of the area between the inf. nuchal line & the F. magnum.
- (4) rectus Capitis post. major: into the lat. part of that area



N.B: the external occipital crest provides attachment to the base of the nuchal ligament.

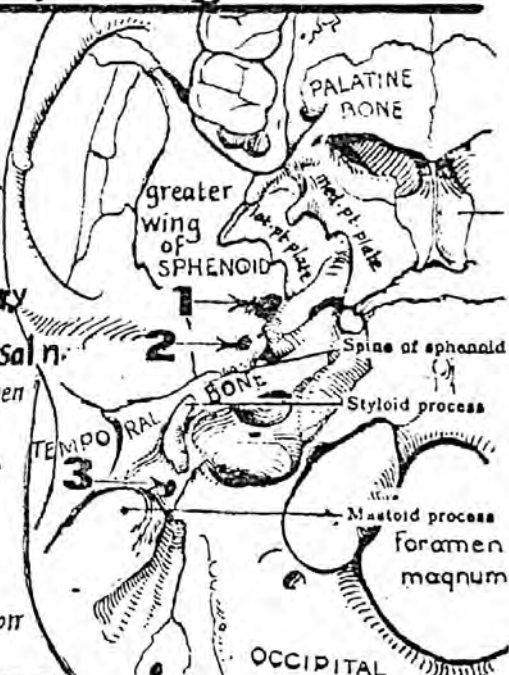
SUMMARY OF FORAMINA & PROCESSES OF NORMA BASALIS EXTERNA 18

1-THE 3 FORAMINA OF THE ANT. PART

Foramen & its site	Structures passing
(1) <u>Incisive fossa</u> : lies at the ant.-end of intermaxillary suture & contains 4 foramina: (a) 2 median foramina (ant. & post.) (b) 2 lateral foramina (Rt. & Lt.)	 → long sphenopalatine nn. (From nose to palate) → greater palatine n. & ves. (From palate to nose)
(2) <u>Greater palatine f.</u> : in front of palatine crest, opposite the 3 rd molar tooth.	greater palatine nerve & vessels.
(3) <u>Lesser palatine foramina</u> (1-3): behind the palatine crest (in the pyramidal process of palatine bone)	lesser palatine nerve & vessels.

2-THE 3 SMALL FORAMINA OF THE MIDDLE PART

They lie along an imaginary line extending from the lat. pterygoid plate to the mastoid process

Foramen & its site	Structures passing
(1) <u>Foramen ovale</u> : in the greater wing of sphenoid posterolat. to the post. margin of the lat. pterygoid plate.	(3 M + A L E): (1) Mandibular nerve (2) Motor root of trigeminal n. (3) Middle meningeal vein (4) Accessory " artery (5) Lesser superficial petrosal n. (may pass through the small foramen innominatum behind the F. ovale). (6) Emissary V. from the pterygoid plexus to the cavernous sinus (may pass through a small F. of Vesalius anterior med. to F. ovale).
(2) <u>Foramen Spinosum</u> : posterolateral to F. ovale	 (1) Middle meningeal artery. (2) Nervus spinosus.
(3) <u>Stylomastoid foramen</u> : between the styloid & mastoid processes	(1) Facial nerve. (2) Stylomastoid a. (br. of post. auricular a.)

3 - THE 3 LARGE FORAMINA OF THE MIDDLE PART

19

They lie along an imaginary line medial to the line of the 3 small foramina.

Foramen & its Site	Structures passing
(1) <u>Foramen lacerum</u> : - lies between : (a) apex of petrous temporal bone (posterolaterally) (b) basi-occiput & body of sphenoid (medially) & the root of pterygoid process (anteriorly). - it is a short wide canal 1cm long.	- its lower end : is closed in the living by fibrocartilage & transmits : (1) meningeal br. of ascending pharyngeal a. (2) emissary V. From cavernous sinus to the pterygoid plexus. - its upper end opens into the middle cranial fossa (see p. 27). 
(2) <u>Carotid Canal</u> : in the petrous temporal bone posterolat. to the f. lacerum. It is directed forwards & medially. Its upper end opens into the post. wall of f. lacerum.	(1) Internal carotid a. (2) Internal carotid symp. plexus (around the artery) (3) Deep petrosal nerve : from the I.C. symp. plexus (4) plexus of emissary veins (Connecting the cavernous sinus with the I.J.V.)
(3) <u>Jugular Foramen</u> : lat. to the occipital Condyle, at the post. end of the petro-occipital fissure & behind the carotid canal.	(1) Inferior petrosal sinus (in the antero-med. part). (2) Internal jugular vein (in its posterolateral »). (3) the 9th, 10th & 11th cranial nerves (in the middle compartment of the foramen).

N.B: (1) Jugular fossa : is a hollowed out space at the post. end of the jugular f. It lodges the sup. bulb of the I.J.V. The lat. wall of the jugular fossa is pierced by a minute canal called the mastoid canaliculus which transmits the auricular branch of the vagus n.

(2) Tympanic canaliculus : is a minute canal between the jugular fossa & carotid canal. It transmits the tympanic br. of glossopharyngeal n. to the middle ear cavity.

4 - THE 3 FORAMINA RELATED TO OCCIPITAL CONDYLES :

Foramen & its Site	Structures passing
(1) <u>Ant. Condylar Foramen</u> (hypoglossal Canal) : above the ant. part of each occipital Condyle.	(1) Hypoglossal n. (12th cranial n. (2) meningeal br. of ascending pharyngeal a. (3) emissary V. from sigmoid sinus to the I.J.V.

Foramen & its site	Structures passing	20
(2) <u>Posterior Condylar f.</u> lies in the condylar fossa behind the occipital condyle (it may be absent)	post. Condylar emissary vein (between the sigmoid sinus & the suboccipital venous plexus)	
(3) <u>Foramen Magnum:</u> (between the 2 occipital condyles)	(A) <u>3 Nervous structures:</u> (1) lower end of the medulla oblongata. (2) tonsils of the cerebellum (Rt. & Lt.). (3) Spinal roots of accessory n. (Rt. & Lt.). (B) <u>3 Vascular structures:</u> (1) Vertebral arteries (Rt. & Lt.). (2) Spinal arteries (one ant. & 2 post.). (3) Vertebral plexus of veins. <u>N.B:</u> vertebral arteries are surrounded by symp. plexus. (C) <u>3 Membranous Structures:</u> (1) Meninges (dura, arachnoid & dura maters). (2) Membrana tectoria (upper end of the post. longitudinal lig. of the vertebral column). (3) Apical lig. (From odontoid process of axis to the basilar part of occipital bone).	

5- THE 3 'HIDDEN' FORAMINA OF THE BASE

Foramen & its Site	Structures passing	
(1) <u>Palatovaginal Canal:</u> on the base of skull, midway between the vomer & the med. pterygoid plate	the pharyngeal branch of the sphenopalatine ganglion.	
(2) <u>Pterygoid Canal:</u> opens into the ant. aspect of F. lacerum above the pterygoid tubercle	the nerve of pterygoid canal (Vidian nerve).	
(3) <u>Bony opening of the Eustachian tube:</u> at the post. end of scaphoid fossa & med. to the spine of sphenoid	the cartilagenous part of the Eustachian tube.	

6- THE 3 FISSURES OF THE BASE

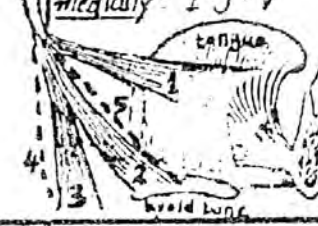
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Fissure & its Site	Structures passing
(1) Inferior Orbital fissure : <i>Between greater wing of sphenoid (above) & the maxilla (below)</i>	(1) <u>Infra-orbital n.</u> (Continuation of maxillary n.) (2) <u>infra-orbital a.</u> (Continuation of maxillary a.) (3) <u>orbital br. of spheno-palatine ganglion.</u> (4) <u>Zygomatic n.</u> (5) <u>emissary v.</u> from inf. ophthalmic v. to the pterygoid plexus of veins
(2) Pterygo-maxillary fissure <i>Between the maxilla anteriorly & the pterygoid process posteriorly.</i>	(1) Maxillary a. (2) Maxillary n. (3) few branches of spheno-palatine ganglion.
(3) Squamo-tympanic fissure <i>Between the tympanic plate & the floor of the mandibular fossa</i>	(1) Chorda tympani n. (2) ant. tympanic a. (br. of maxillary a.)



7- THE 3 PROCESSES OF THE BASE

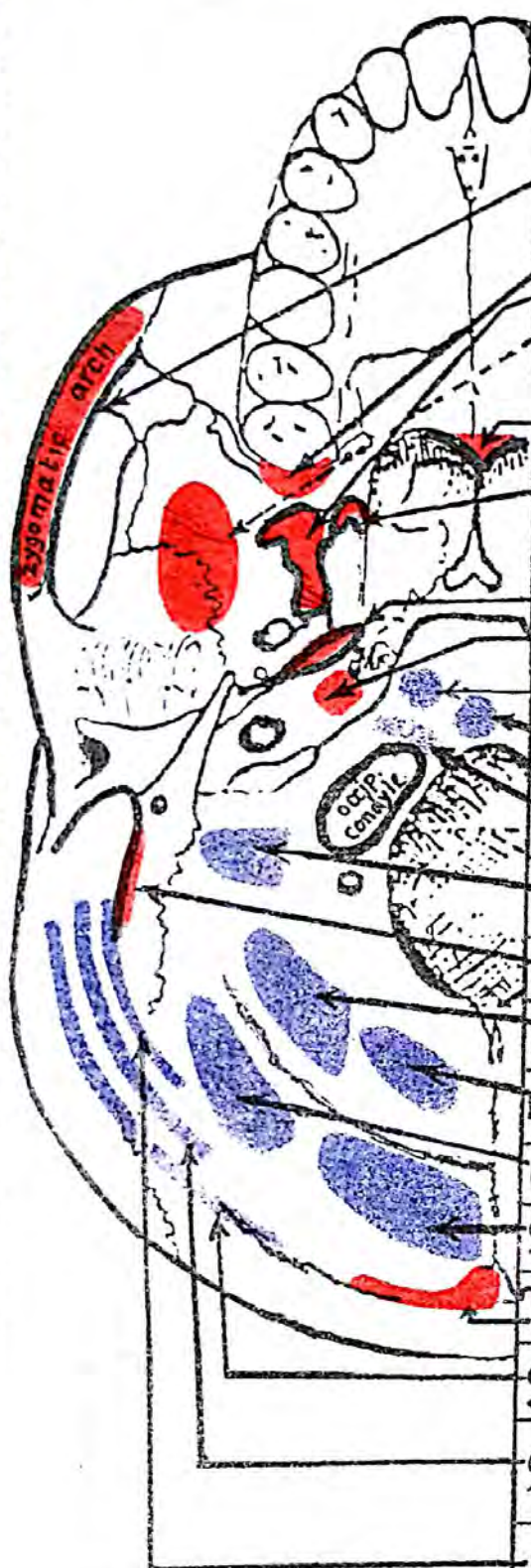
they lie along the line of the 3 small foramina i.e a line extending from the lat. pterygoid plate to the mastoid process.

Process	relations	structures attached :
(1) spine of sphenoid	<u>Laterally:</u> auriculo-temporal n. <u>medially:</u> chorda tympani n. & Eustachian tube.	• Spheno mandibular lig.
(2) Styloid process	<u>laterally:</u> parotid gland <u>medially:</u> I. J. V	• <u>3 muscles & 2 ligaments :</u> (1) Styloglossus m. (2) Stylo hyoid m. (3) Stylo pharyngeus m. (4) stylo mandibular lig. (5) Stylo hyoid lig.
(3) Mastoid process		• <u>its inner surface :</u> origin of post. belly of digastric m. • <u>its outer surface :</u> insertion of 3 muscles (1) Sternomastoid m. (2) Splenius Capitis m. (3) Longissimus Capitis m.



MUSCLES ATTACHED TO NORMA BASALIS EXTERNA

22



Muscle	Site
Masseter	lower border & inner surface of the Zygomatic arch
Superficial head of Med. pterygoid	- maxillary tuberosity
Deep head of Med. pterygoid	- med. surface of lat. pterygoid plate
Upper head of lat. pterygoid	- infratemporal surface of gr. wing of sphenoid
Lower head of lat. pterygoid	- lat. surface of lat. pterygoid plate.
Musculus uvulae	post. nasal spine
Sup. constrictor m. of Pharynx (highest fibres).	pterygoid hamulus
Tensor palati m.	Scaphoid fossa
Levator palati m.	quadrate area at apex of petrous temp. bone
Longus Capitis m.	basilar part of occipital bone
Median raphe of pharynx	Pharyngeal tubercle
Rectus Capitis ant.	basilar part of occipital bone in front of occipital Condyle
Rectus Capitis lateralis	Jugular process of occipital bone lat. to the occipital Condyle
Post. belly of digastric	med. surface of mastoid process
Rectus Capitis post. major	lat. part of the area in front of the inf. nuchal line
Rectus Capitis post. minor	med. part of the area in front of the inf. nuchal line
Obliquus Superior	lat. part of the area between sup. & inf. nuchal lines
Semispinalis Capitis	med. part of the area between sup. & inf. nuchal lines
Trapezii	ext. occipital protuberance & med. 1/3 of the sup. nuchal line
Sternomastoid	lat. surface of mastoid process + lat. 1/3 of the sup. nuchal line
Splenius Capitis	lat. surface of mastoid process behind the sternomastoid
Longissimus Capitis	lat. surface of mastoid process behind splenius capitis

0 = origin

1 = Insertion

CRANIAL CAVITY

23

(A) INNER SURFACE OF SKULL CAP

* Bones:

- Frontal bone : anteriorly
- parietal bones : on the sides
- occipital bone : most posteriorly

* Sutures: Coronal, sagittal & lambdoid.

* Particular Features:

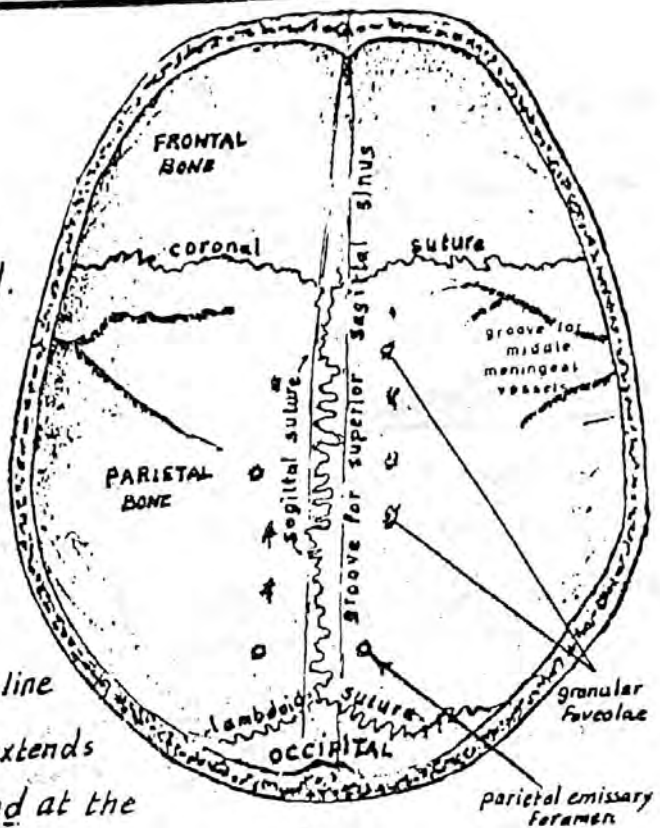
(1) Frontal crest: projects most anteriorly in the median plane. It gives attachment to the apex of the Falx Cerebri.

(2) Sagittal sulcus: a groove in the middle line starting anteriorly at the frontal crest & extends backwards along the sagittal suture to end at the internal occipital protuberance. It lodges the superior sagittal sinus.

(3) Granular foveolae: shallow pits on either side of the sagittal sulcus. They are produced by the arachnoid granulations.

(4) Parietal emissary foramen: ... mentioned before in norma verticalis (Page 2)

(5) Grooves for branches of middle meningeal vessels.



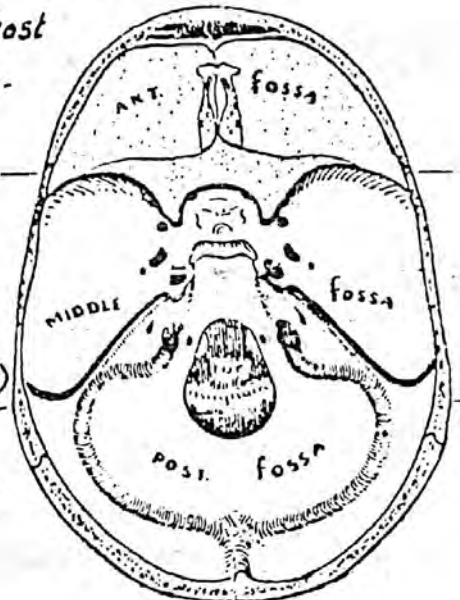
(b) NORMA BASALIS INTERNA

- The norma basalis interna is divided into 3 Cranial Fossae:

(1) Ant. cranial fossa: is the highest, smallest & most anterior one. It lodges the frontal lobes of the brain. Its floor forms the roof of the nose & the 2 orbits.

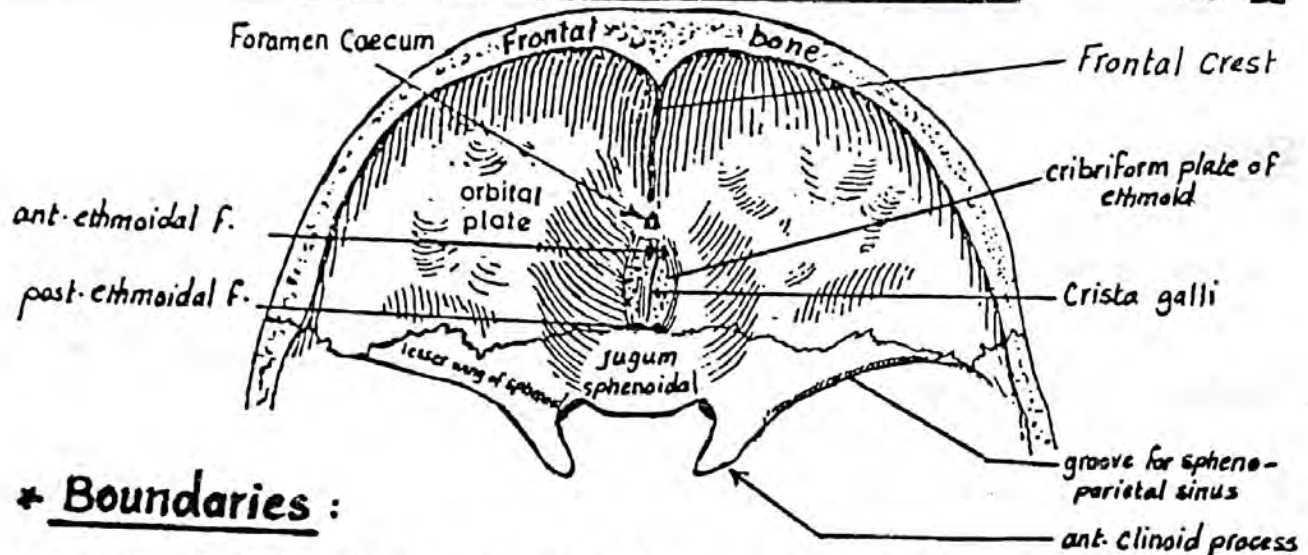
(2) Middle Cranial fossa: lies behind & below the ant. fossa & has a butterfly shape. It has a small median part (lodging the pituitary gland) & 2 large lat. parts (lodging the temporal lobes of brain).

(3) Post. Cranial fossa: is the widest, deepest & most post. of the 3 fossae. It lodges the hind brain (Cerebellum, pons & medulla).



1- Anterior Cranial Fossa

24



* Boundaries :

- anteriorly & laterally : by frontal bone
- posteriorly : by post. margins of the lesser wings of sphenoid bone

* Bones forming the floor of the fossa :

anteriorly → (1) orbital plates of frontal bone (on either side)
→ (2) Cribriform plate of ethmoid bone (in between the 2 orbital plates)

Posteriorly → (1) lesser wings of sphenoid (on either side)
→ (2) Jugum sphenoidale (ant. part of body of sphenoid) : in the middle.

* Particular Features :

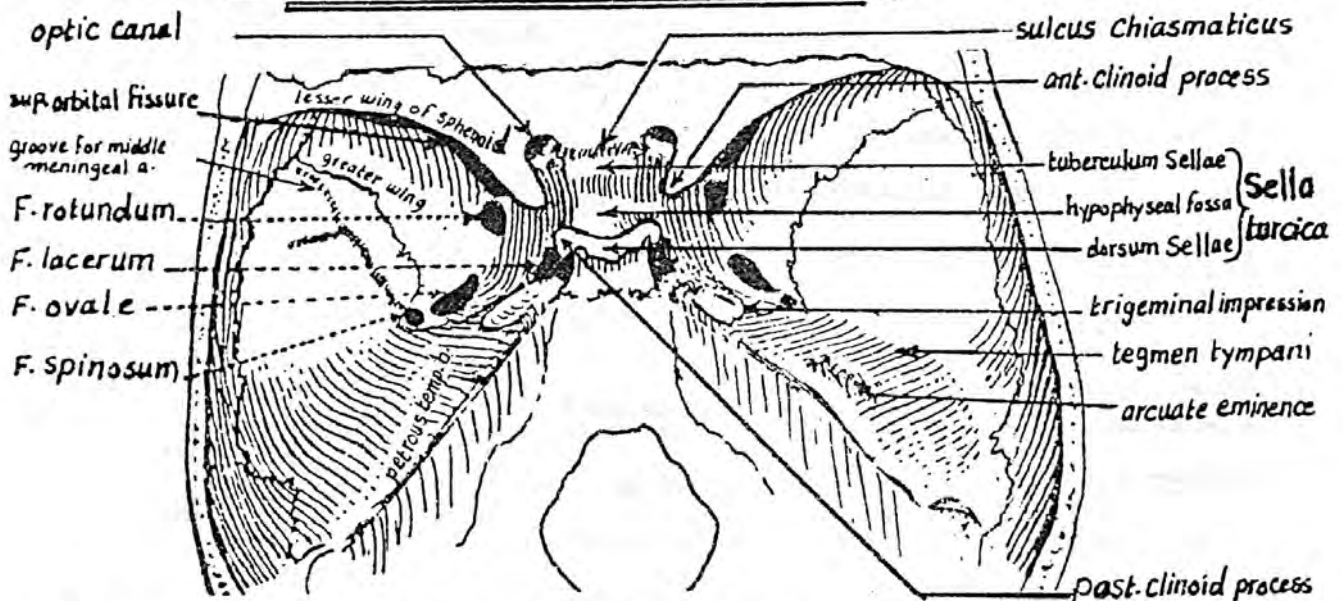
- (1) Orbital plates of frontal bones : separate the ant. cranial fossa from the orbital cavities. Their surfaces show irregular depressions produced by the gyri of the inf. surfaces of the frontal lobes of the brain.
- (2) Frontal crest : a median bony projection. It gives attachment to the apex of the falx cerebri.
- (3) Cribriform plate of ethmoid : a perforated bony plate which separates the ant. cranial fossa from the nasal cavity.
- (4) Crista galli : a median bony projection from the cribriform plate of ethmoid. It gives attachment to the apex of the falx cerebri.
- (5) Jugum sphenoidale : is the ant. part of the body of sphenoid lying behind the cribriform plate of ethmoid. It contains the sphenoidal air cells.
- (6) Lesser wing of sphenoid : extends laterally from the jugum sphenoidale. Its post. free margin is grooved by the sphenoparietal sinus. It ends medially by the ant. clinoid process which gives attachment to the free border of tentorium cerebelli.

* Foramina of the ant. Cranial fossa:

25

Foramen & its Site	Structures Passing
(1) <u>Foramen Caecum:</u> between frontal crest & Crista galli	• usually closed by the fibrous tissue of the falx Cerebri (Called Sharpey's Fibre) • Sometimes it is patent & transmits an emissary vein (Connecting the Sup. sagittal sinus with the nasal veins).
(2) <u>Foramina of the Cribiform plate of ethmoid</u>	• olfactory nerves (from the nasal mucosa to the olfactory bulb of brain.
(3) <u>Ant. ethmoidal Foramen</u> a slit alongside the ant. end of Crista galli	• ant. ethmoidal n. & vessels .
(4) <u>Post. ethmoidal f.</u> at the posterolat. corner of Cribiform plate of ethmoid	• post. ethmoidal n. & vessels .

2-Middle Cranial Fossa



* Boundaries : anteriorly : post. borders of lesser wings of sphenoid & ant. Clinoid processes
 posteriorly : sup. borders of petrous temporal bones & dorsum sellae

* Bones forming its floor :

- In the middle : Sella turcica (Turkish Saddle) formed by the body of Sphenoid.
- on either side : (1) greater wing of sphenoid : anteriorly
 (2) petrous temporal bone : posteriorly
 (3) Squamous " " : laterally

(1) Sella turcica : turkish Saddle-shaped part formed by the body of sphenoid & includes the following:

- (a) Hypophyseal (pituitary) fossa: a depression in the upper surface of the body of sphenoid. It lodges the hypophysis (pituitary gland).
- (b) Tuberculum Sellae: a median projection in front of the hypophyseal fossa.
- (c) Dorsum Sellae: an upward projection of sphenoid behind the hypophyseal fossa.
- (d) Post. Clinoid processes: the expanded lat. ends of the dorsum Sellae. They give attachment to the ant. ends of the attached margins of the tentorium cerebelli.

(2) Sulcus Chiasmaticus: a shallow transverse groove in front of the tuberculum Sellae & leads to optic canal on each side. It is related to the optic Chiasma which lies above & behind the sulcus

(3) Greater wing of sphenoid: lies lateral to the Sella turcica & shows

A Crescent of foramina:

- (a) Sup. orbital fissure: between the greater wing (below) & lesser wing (above)
- (b) F. rotundum: rounded f. behind the med. end of the sup. orbital fissure.
- (c) F. ovale: an oval f. behind the f. rotundum.
- (d) F. spinosum: posterolat. to f. ovale

N.B: 2 other small foramina May perforate the greater wing of sphenoid:

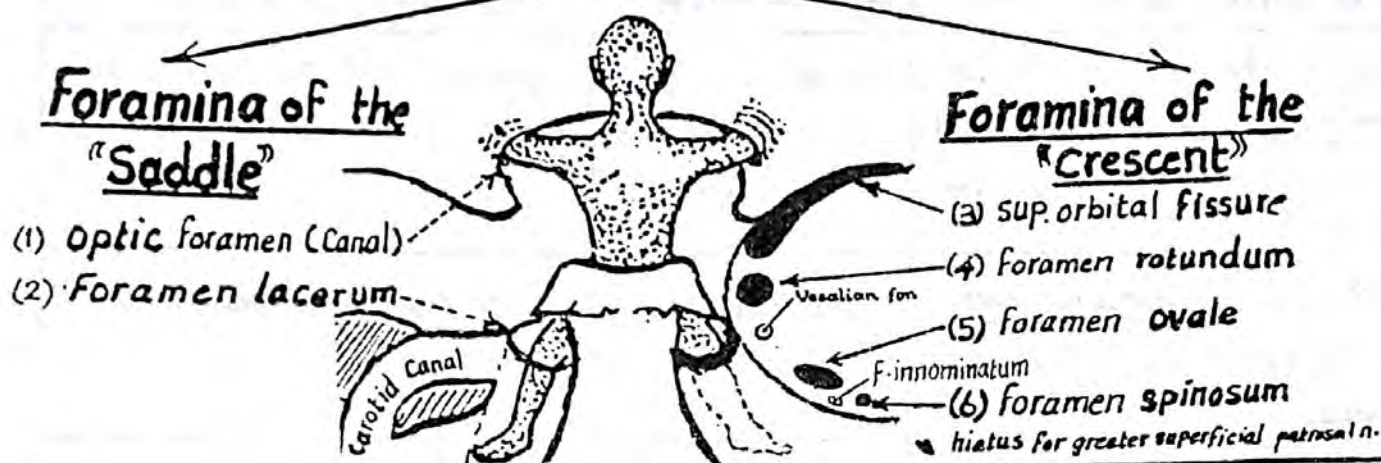
- (e) Vesalian f. (sphenoidal emissary f.): lies anteromedial to f. ovale
- (f) f. innominatum: lies posterior to f. ovale

(4) Petrous temporal bone (its ant. surface): shows the following features:

- (a) upper end of F. lacerum: in front of the apex of the petrous temporal bone. It leads anteriorly to a groove lat. to the hypophyseal fossa (lodging the I.C.A)
- (b) Trigeminal impression: a depression at the apex of the petrous temp. bone post. to f. lacerum. It lodges the trigeminal ganglion.
- (c) Arcuate eminence: an elevation posterolateral to the trigeminal impression. It is produced by the sup. semicircular canal of internal ear.
- (d) Tegmen tympani: is the thin bone anterolateral to the arcuate eminence. it forms the roof of the tympanic cavity.
- (e) Hiatus & groove for greater superficial petrosal n.: lat. to the trigeminal impression
- (f) " " " lesser " ": lat. to those of G.S. petrosal n. & parallel to them.

Foramina of the Middle Cranial Fossa

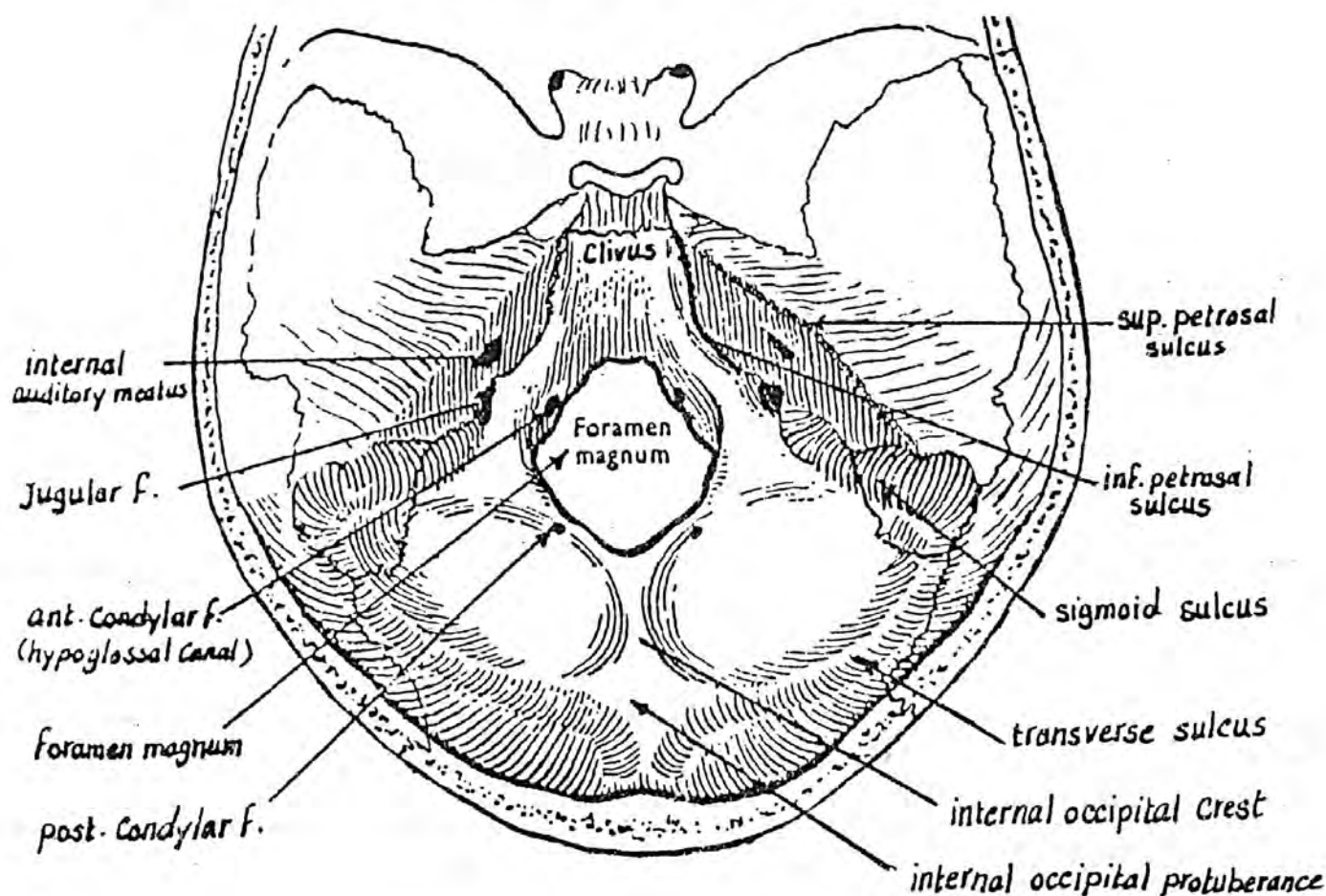
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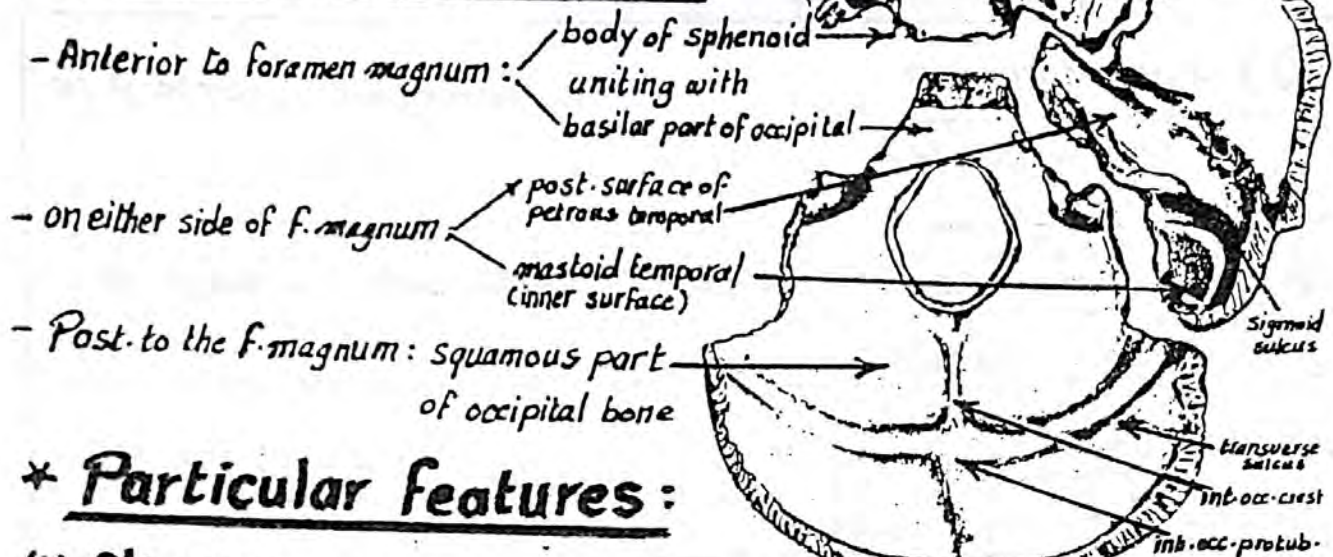
Foramen & its Site	Opens into	Structures passing through
(1) <u>Optic f. (Canal)</u> between the 2 roots of the lesser wing of sphenoid	Orbital Cavity	(1) Optic n. (with the surrounding meninges) (2) Ophthalmic artery.
(2) <u>F. lacerum</u> (upper end) in front of the apex of the petrous temporal bone	middle part of the norma basalis externa	(1) Internal Carotid a. (2) Internal Carotid sympathetic plexus around the artery <u>N.B</u> these structures reach the F. lacerum through the Carotid canal which opens into the upper end of the F. lacerum (3) meningeal br. of ascending pharyngeal a. (4) emissary v. from the Cavernous sinus to the pterygoid plexus of veins
(3) <u>Sup. orbital fissure</u> between the lesser & greater wings of sphenoid	Orbital Cavity	(1) Oculomotor (3rd cr.) n. → divides into sup. division & inf. division. (2) Trochlear (4th cr.) n. (3) Ophthalmic of 5th cr. n. → divides into lacrimal, frontal & nasociliary. (4) Abducent n. (6th cr.) n. (5) Ophthalmic veins
(4) <u>F. rotundum</u> behind the med. end of the sup. orbital fissure	pterygo-palatine fossa (post. wall)	Maxillary n.
(5) <u>F. Ovale</u> behind F. rotundum.	Infra-temporal fossa	See page 18
(6) <u>F. Spinosum</u> Postero-lateral to F. ovale	„	„ „ „

Foramen & its Site	Opens into	Structures passing
(1) <u>Hiatus for greater superficial petrosal n.</u> : in the ant. surface of the petrous temporal bone lat. to the trigeminal impression	facial canal inside the petrous temporal bone	greater superficial petrosal n. (br. of facial n.)
(2) <u>Hiatus for lesser superficial petrosal n.</u> : lat. to that for greater .s. petrosal n.	tympanic Cavity	lesser superficial petrosal n.
(3) <u>Vesalius</u> (sphenoidal emissary) f. may be found anteromedial to f. ovale	infra-temporal fossa	if present, it transmits an emissary v. from pterygoid plexus to cavernous sinus
(4) <u>Foramen Innominatum</u> may be found behind f. ovale	))	lesser superficial petrosal n.

3-Posterior Cranial fossa



* Bones forming the fossa:



* Particular Features:

(1) Clivus: is the sloping surface formed by the fusion of body of sphenoid and the basilar part of occipital bone. It is related to medulla (below); pons & basilar a. (above).

(2) Squamous occipital bone: Shows the following features:

- internal occipital protuberance: a median irregular eminence
- internal occipital crest: extends from the ext. occ. protuberance to f. magnum.
- transverse sulcus: a groove extending laterally from the ext. occipital protuberance to become continuous with the Sigmoid sulcus. It lodges the transverse sinus.

(3) mastoid & petrous parts of temporal bone: show the following features:

- Sigmoid sulcus: a continuation of the transverse sulcus downwards & medially on the mastoid temporal bone to end at the jugular foramen. It lodges the Sigmoid S.
- Sup. petrosal sulcus: a groove for sup. petrosal sinus found along the sup. border of the petrous temporal bone
- Inferior petrosal sulcus: a groove along the petro-occipital fissure ending behind at the jugular foramen. It lodges the inf. petrosal sinus.

* Foramina of post. Cranial Fossa:

Foramen & its site	Structures passing
(1) <u>Internal auditory meatus</u> : on the post. surface of the petrous temporal bone	(1) Facial n. (the 7th cranial n.) (2) Vestibulo-Cochlear n. (auditory, 8 cr. n.) (3) Internal auditory vessels.

Foramen & its Site	Structures passing
(2) <u>Jugular Foramen</u> at the post-end of the petro-occipital fissure	See norma basalis externa P. 19
(3) <u>Ant. Condylar F. (hypoglossal Canal)</u> below & medial to the jugular F.	See norma basalis externa P. 19
(4) <u>Post. Condylar F.</u> (may be absent) postero-lateral to the ant. condylar F.	see norma basalis externa P. 20
(5) <u>Foramen Magnum</u>	" " " " P. 20
(6) <u>Mastoid emissary F.</u> : opens into the post part of the sigmoid sulcus	see norma occipitalis P. 4

BONY CANALS OF THE SKULL & MANDIBLE

- (1) Facial canal (2) Carotid Canal (3) Optic Canal
 (4) Nasolacrimal Canal (5) infra-orbital Canal (6) pterygoid Canal
 (7) palatovaginal Canal (8) Bony canal for auditory tube.
 (9) greater palatine Canal (10) hypoglossal Canal (11) mandibular Canal

SEXUAL CHARACTERISTICS OF SKULL & MANDIBLE

(A) Skull:

- (1) superciliary arches & glabella are more prominent in males.
- (2) nuchal area : is rough in males but smooth in females.
- (3) mastoid processes are well developed in the male.
- (4) frontonasal junction is smooth in the female & angular in the male.

N.B : the differentiation between the male & female skull is not so easy.

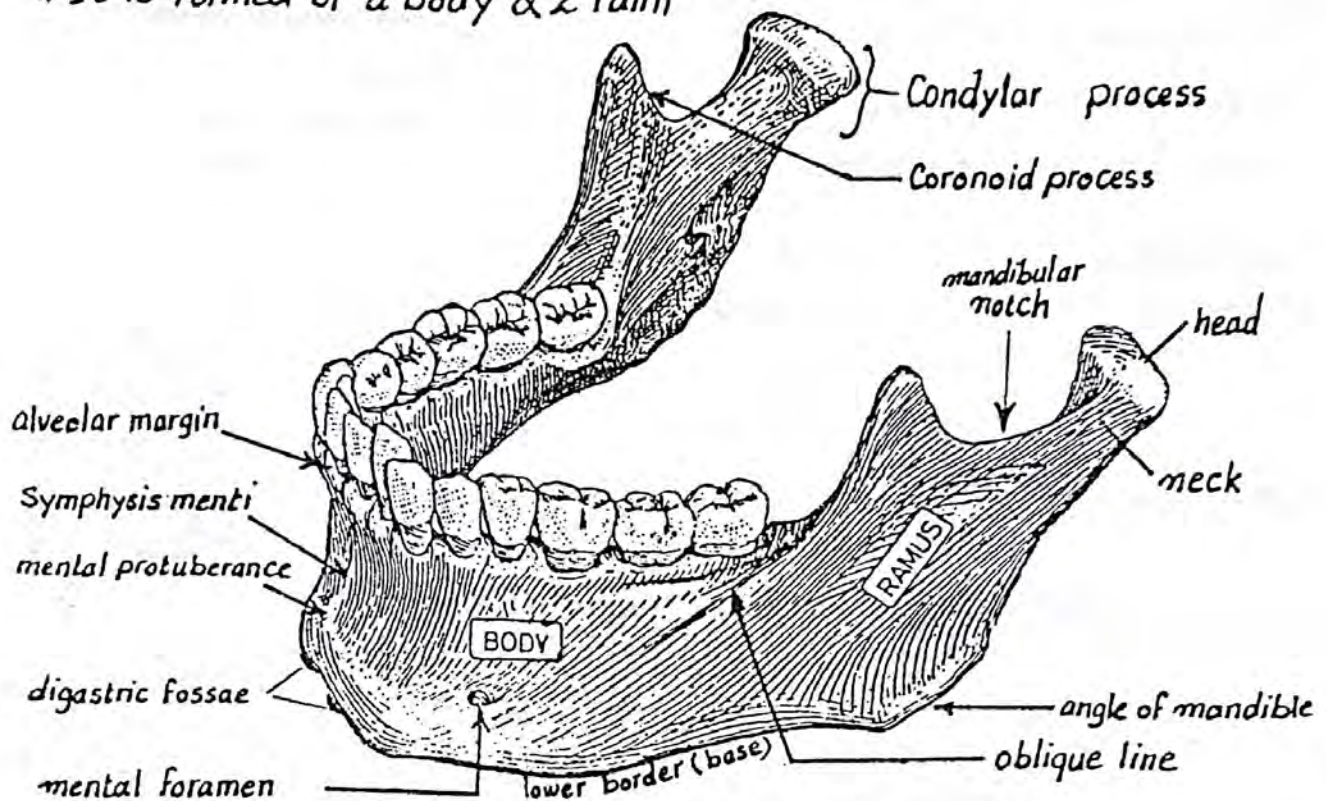
(B) Mandible:

- (1) the mandible is rough & heavy in the male but smooth & light in the female.
- (2) mental protuberance is prominent in the male.
- (3) angle of mandible:
 - rough & everted in the male.
 - smooth & inverted in the female.

MANDIBLE

31

- * It is the bone of the lower jaw (the only movable bone of the skull)
- * It is formed of a body & 2 rami



A- BODY OF THE MANDIBLE

- * It is horse-shoe shaped having : 2 borders (upper & lower)
2 Surfaces (outer & inner)
- * upper border (alveolar margin) : Carries the sockets for 16 teeth.
- * lower border (base of mandible) :
 - Continuous posteriorly with the post. border of the ramus.
 - Shows a digastric fossa on either side of the middle line anteriorly.
- * Outer surface : shows the following features :
 - (1) Symphysis menti : a faint median ridge representing the site of fusion between the 2 foetal halves of the mandible (at the age of one year).
 - (2) mental protuberance : a triangular raised area at the lower part of symphysis menti.
 - (3) mental foramen : lies opposite the line between the 2 premolars. It is the ant. end of the mandibular canal & transmits the mental nerve & vessels.

(4) Oblique line: extends from the ant. border of the ramus to the mental foramen.

* Inner Surface:

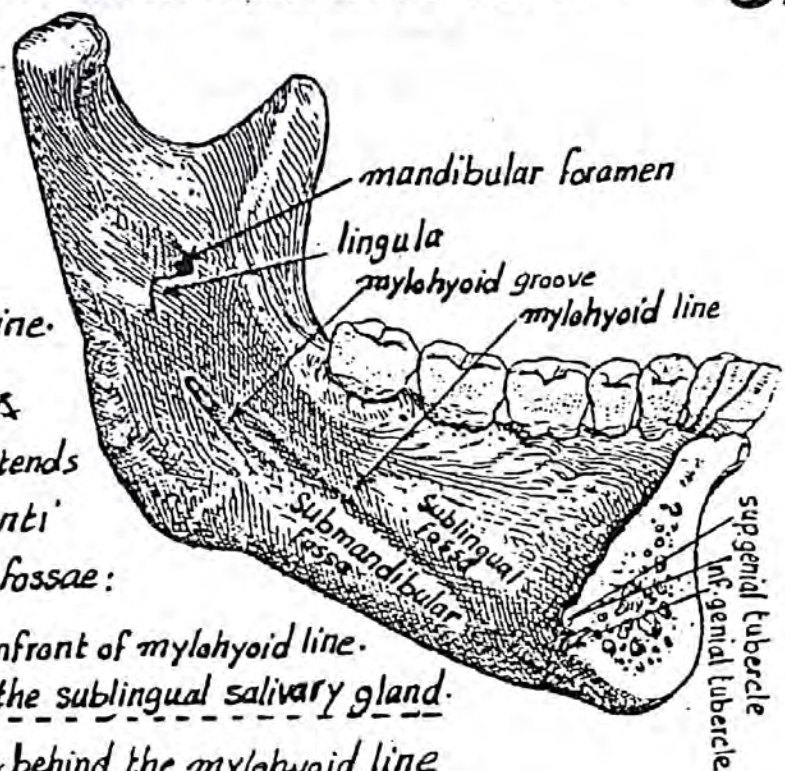
(1) sup. & inf. genial tubercles:

Project from the lower part of inner surface close to the middle line.

(2) Mylohyoid line: begins below & behind the last molar tooth & extends downwards to the symphysis menti dividing the inner surface into 2 fossae:

(3) Sublingual fossa: above & in front of mylohyoid line.
It lodges the sublingual salivary gland.

(4) Submandibular fossa: below & behind the mylohyoid line
it lodges the submandibular salivary gland.



B- RAMUS OF MANDIBLE

* It projects upwards on either side from the posterior part of the body. It has 4 borders, 2 surfaces & 2 processes.

- upper border: forms the mandibular notch between the coronoid & condylar processes.

- Lower border: is continuous with the lower border of the body.

It meets the post. border of the ramus at the Angle of mandible

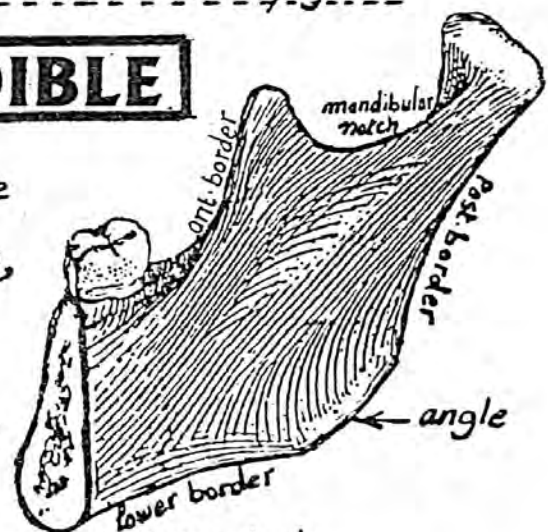
- Post. border: extends from the angle to the back of the condylar process.

- Ant. border: Continuous above with the ant. border of coronoid process & below with the oblique line of the body.

- Outer (lateral) surface: Continuous with the outer surface of the body.

- Inner (medial) surface: shows the following features:

(1) mandibular foramen: in the centre of the ramus. It leads to the mandibular canal & transmits the inf. alveolar n. & vessels.



(3) Lingula : a small tongue like process overhanging the mandibular foramen anteriorly.

(4) Mylohyoid groove : starts below the mandibular foramen & passes downwards & forwards to end below the post. end of the mylohyoid line of the body - it lodges the mylohyoid nerve & vessels.

- Coronoid process : an upward flattened projection from the ant. end of the ramus

- Condylar process : an upward & backward projection from the post. part of the ramus. It consists of :

(1) head of the mandible : articulates with the mandibular fossa of the skull in the T.M.J. It can be felt subcutaneously in front of tragus of ear.

(2) neck of mandible : the constriction below the head.

Its anteromedial aspect shows a depression called pterygoid fossa

MUSCLES ATTACHED TO THE MANDIBLE

(A) The Ramus : receives the insertions of the 4 muscles of mastication.

(1) Masseter : inserted into the outer surface of the ramus

(2) Temporalis : " " " tip + ant. border + med. surface of Coronoid process.

(3) Lat. pterygoid : into pterygoid fossa of the anteromed. surface of the neck

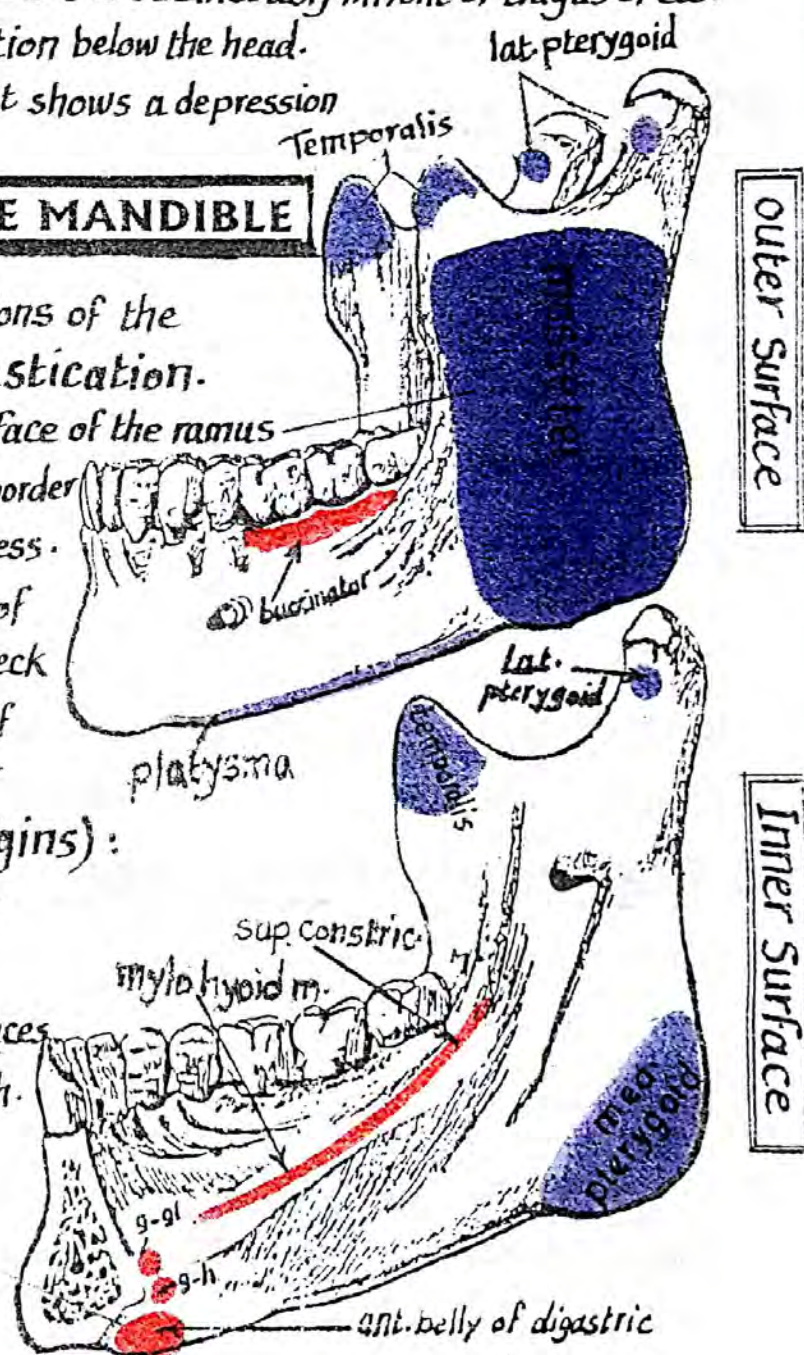
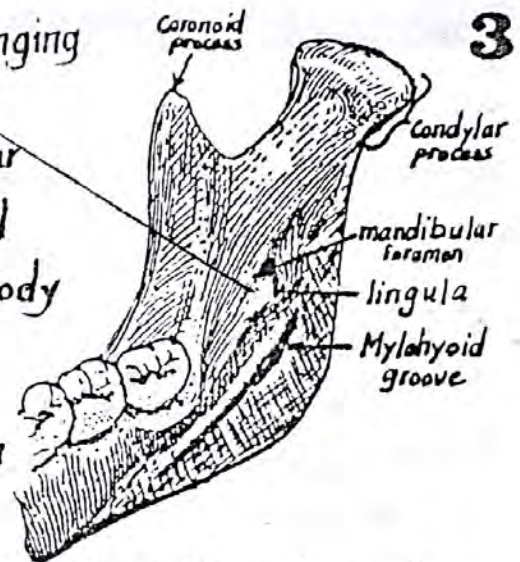
(4) Med. Pterygoid : into the inner surface of the angle of mandible.

(B) The Body : (1 insertion & 6 origins) :

(1) platysma : inserted into the lower border of the body

(2) buccinator : arises from the outer surfaces of the sockets of the 3 molar teeth.

(3) anterior belly of digastric m. : arises from the digastric fossa at the lower border of the mandible close to the symphysis menti.



outer Surface

Inner Surface

- (4) genio-glossus: arises from the sup. genial tubercle
 (5) genio-hyoid: " " " " inf. genial tubercle
 (6) mylohyoid: arises from the whole length of the mylohyoid line
 (7) Sup. constrictor m. of pharynx: arises from the post-end of the mylohyoid line.

* **LIGAMENTS ATTACHED TO THE MANDIBLE**

(1) Temporo-mandibular lig.

- it extends from the articular eminence of the skull to the lat. surface of the neck of mandible
- it is the thickened lat. part of the Capsule of the T.M.J

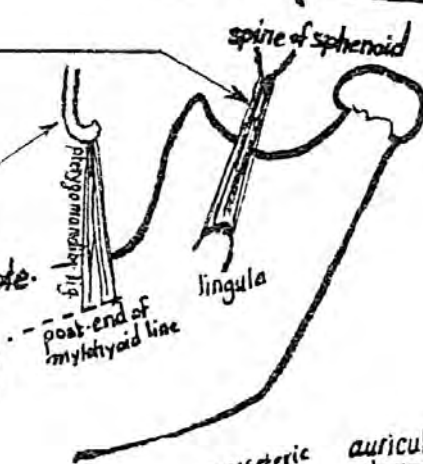
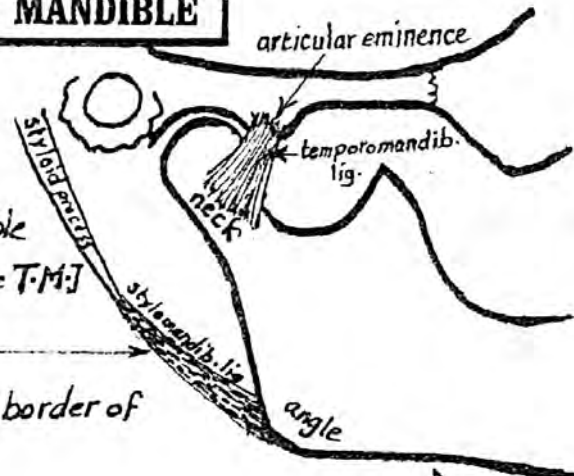
(2) Stylo-mandibular lig.

- extends from the styloid process to the post. border of the angle of mandible

(3) Sphenomandibular lig.

- extends from the spine of sphenoid to the lingula of mandible.

(4) Pterygo-mandibular lig.: extends from the pterygoid hamulus to the post end of mylohyoid line of mandible.



* **NERVES RELATED TO THE MANDIBLE**

(A) 2 nerves related to foramina:

- (1) inferior alveolar n.: enters into the mandibular f. & passes through the mandibular canal where it divides into the incisive n. (supplying the teeth) & the mental n.

- (2) Mental n.: emerges from the mental foramen.

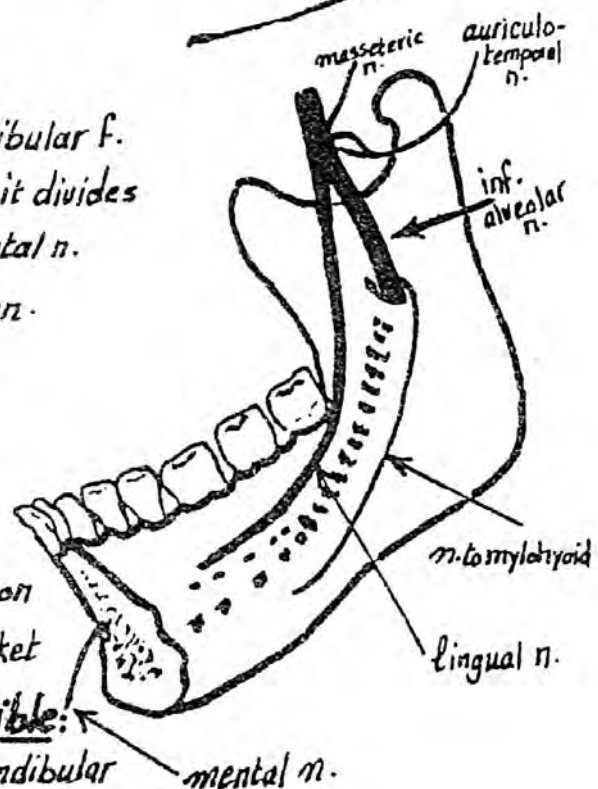
(B) 2 nerves related to grooves:

- (1) n. to mylohyoid: runs forwards in the mylohyoid groove

- (2) Lingual n.: runs forwards along the groove on the med. aspect of the last molar tooth socket

(C) 2 nerves related to the neck of mandible:

- (1) masseteric n.: passes laterally through the mandibular notch in front of the neck.



- (2) auriculo-temporal n. : passes backwards medial to the neck of the mandible then upwards behind the T.M.J

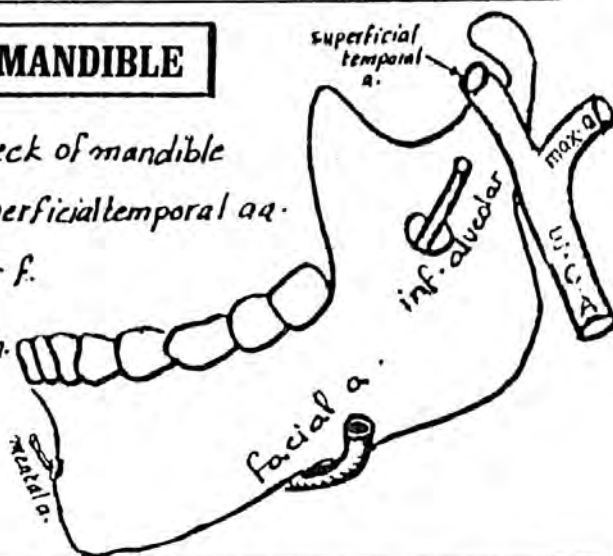
(D) 2 other nerves are related to the mandible :

- (1) buccal br. of mandibular n. : descends in front of ant. border of the ramus
(2) marginal mandibular br. of facial n. runs forwards on the outer surface of the body



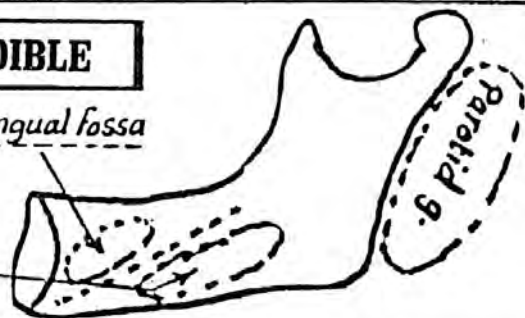
ARTERIES RELATED TO THE MANDIBLE

- (1) the external Carotid a. : divides deep to the neck of mandible into its 2 terminal branches : maxillary & superficial temporal aa.
(2) the inf. alveolar a. : enters into the mandibular f.
(3) the mental a. : emerges from the mental foramen.
(4) the facial a. : curves around the lower border of mandible at the antero inferior angle of masseter m.

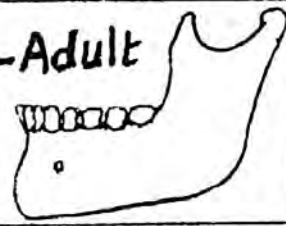
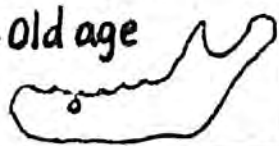


GLANDS RELATED TO THE MANDIBLE

- (1) Sublingual salivary gland : related to the sublingual fossa
(2) submandibular " " : related to the submandibular fossa
(3) Parotid gland : related to the post. border of the ramus



HOW TO KNOW ROUGHLY THE AGE OF THE MANDIBLE ?

Age	Angle	Mental foramen	alveolar margin
- At birth 	About 170° (very obtuse)	near the lower border	no eruption of teeth
- At 4 Years 	About 145° (25° less)	slightly higher in position	eruption of the 10 milk teeth
- Adult 	About 120° (25° less)	midway between the upper & lower borders	eruption of the 16 permanent teeth
- Old age 	About 145° (like young age again)	near the upper border (due to absorption of the alveolar margin)	Shows loss of teeth & absorption of the alveolar margin

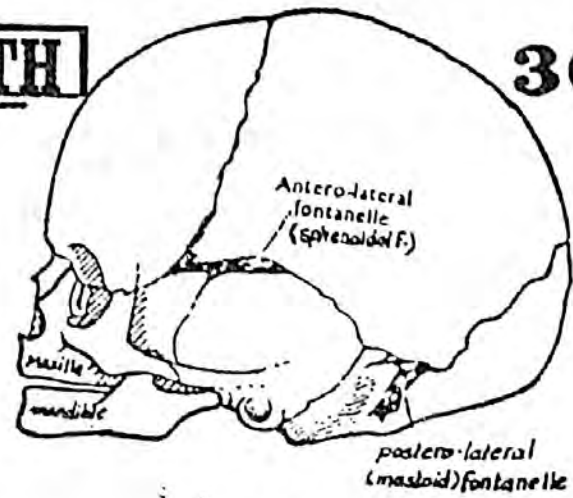
THE SKULL AT BIRTH

36

It is characterized by the following :

(1) The Face : is small in size because :

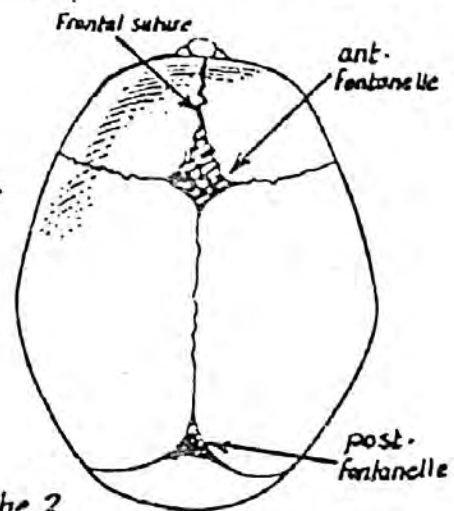
- (a) the maxilla & mandible are not completely developed & the maxillary sinus is very small
- (b) No teeth are present.



(2) The Mandible : is divided into 2 halves
(unite at the age of one year) .

(3) The Frontal bone : is formed of 2 halves
(they start to unite at the age of 2 years & unite completely at 10 years) .

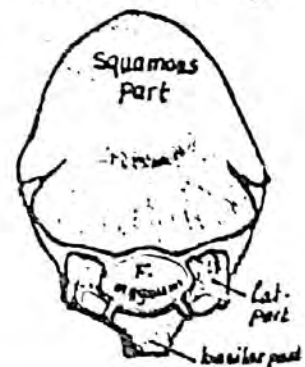
(4) The Calvaria (Skull Cap) : is large because
the brain is relatively large in size .



(5) The presence of 6 Fontanelles :

- (a) anterior fontanelle : a rhomboidal membrane between the 2 parietal bones & the 2 halves of the frontal bone (Closes at the age of $1\frac{1}{2}$ years) .
- (b) Posterior fontanelle : a triangular membrane between the 2 parietal bones & the occipital bone (it closes at the age of 8 months) .
- (c) Antero-lateral or sphenoidal fontanelle (one on each side at the region of the pterion) which close at the age of 3 months .
- (d) Postero-lateral or mastoid fontanelle (one on each side at the region of the Asterion) which also close at the age of 3 months .

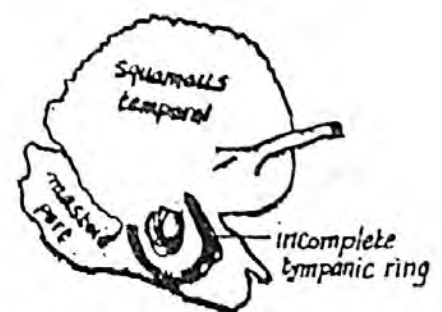
(6) the occipital bone : is formed of : squamous part, 2 lat. parts & a basilar part which are still separated by cartilage .



(7) the basilar part of sphenoid & the basilar part of occipital bone are separated by cartilage .

(8) The temporal bone : shows :

- (a) Undeveloped mastoid & styloid processes
- (b) Incomplete tympanic ring and the external auditory meatus is formed by the cartilagenous part only & the tympanic membrane is superficial.



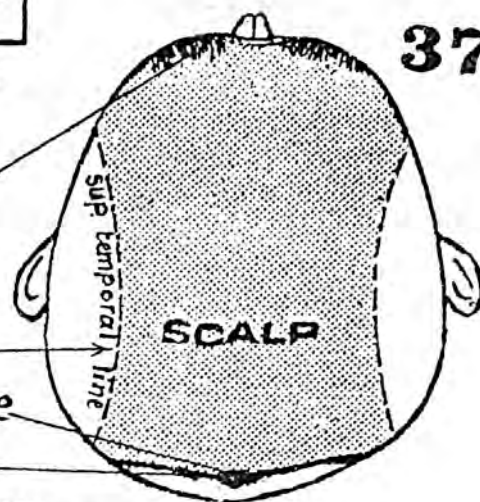
THE SCALP

37

*Definition: it is the soft tissue covering the vault of the skull.

*Extent:

- anteriorly: supra orbital margins (skin of the eye brows)
- on each side: superior temporal lines
- posteriorly: external occipital protuberance & highest nuchal lines



*Structure (Layers) of the scalp (S.C.A.L.P):

(1) S: Skin:

- thick, rich in hair follicles & sebaceous glands
- the commonest site for formation of sebaceous cysts

(2) C: Connective tissue:

- is dense & consists of lobules of fat bound in fibrous septa
- it contains the vessels & nerves of the scalp.

(3) A: Aponeurosis of occipito frontalis muscle:

- it is called the Epicranial Aponeurosis
- it is connected anteriorly to the frontal bellies
- " " " posteriorly to the occipital bellies.
- it is attached on each side to sup. temporal line

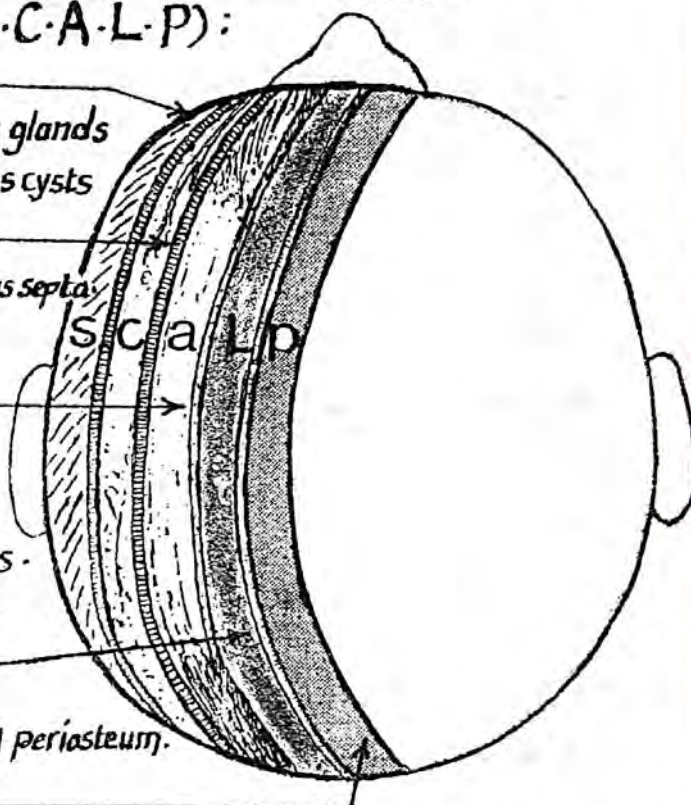
(4) L: Loose areolar connective tissue:

- allows mobility of the aponeurosis on the underlying periosteum.

(5) P: periosteum (pericranium):

- it is loosely attached to the bones but firmly adherent to the sutures between bones.

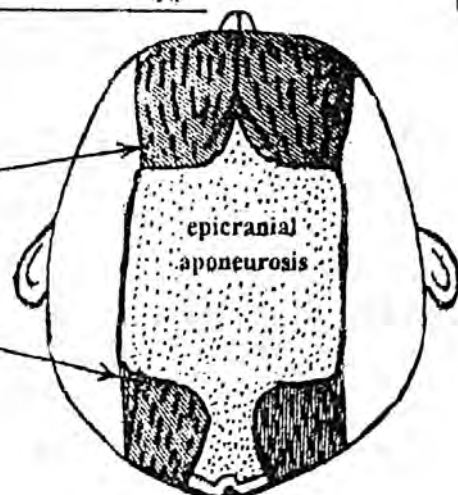
N.B: Fissure or fracture of a skull bone produces a localized hematoma overlying that bone as periosteum is firmly attached to sutural lines



occipito frontalis muscle

* It is a muscle of the scalp formed of

- (a) 2 Frontal bellies anteriorly
- (b) 2 occipital " posteriorly
- (c) an aponeurosis called epicranial aponeurosis connecting the frontal & occipital bellies together.

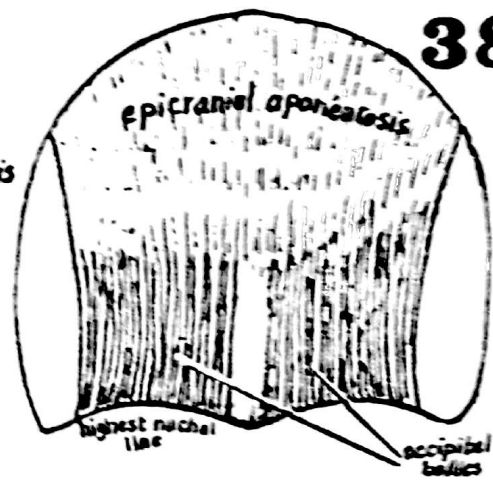


(a) Occipital bellies : are separate

origin : From the highest nuchal lines

insertion : into the post. border of epicranial aponeurosis

n. supply : post. auricular branch of Facial nerve.



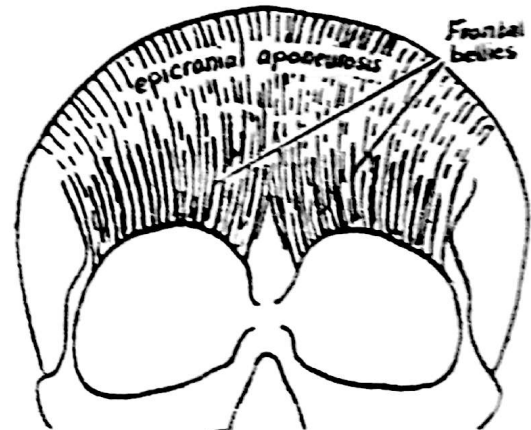
38

(b) Frontal bellies : are larger & fused together

Origin : from ant. border of epicranial aponeurosis

insertion : into the skin of the eye brows

n. supply : temporal branch of Facial n.



(c) Epicranial Aponeurosis : a sheet of strong

Fibrous tissue over the skull cap.

- anteriorly : it is attached to the frontal bellies

- posteriorly : • • • • • Occipital bellies

- on either side : • • • • the Sup. temporal line.

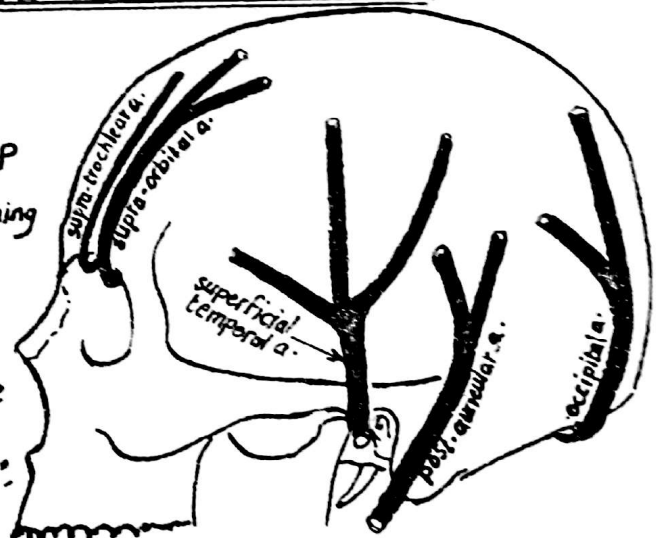
Action of the occipito-frontalis m. (a) the occipital bellies : tighten the epicranial aponeurosis

(b) the frontal bellies : elevate the eye brows

ARTERIAL SUPPLY OF THE SCALP

- the Scalp has a very rich blood supply.
- 10 arteries (5 on each side) enter the scalp from its periphery and ramify in its centre forming a very rich anastomosis
- 5 arteries enter the scalp on each side :
3 in front of the auricle & 2 behind the auricle

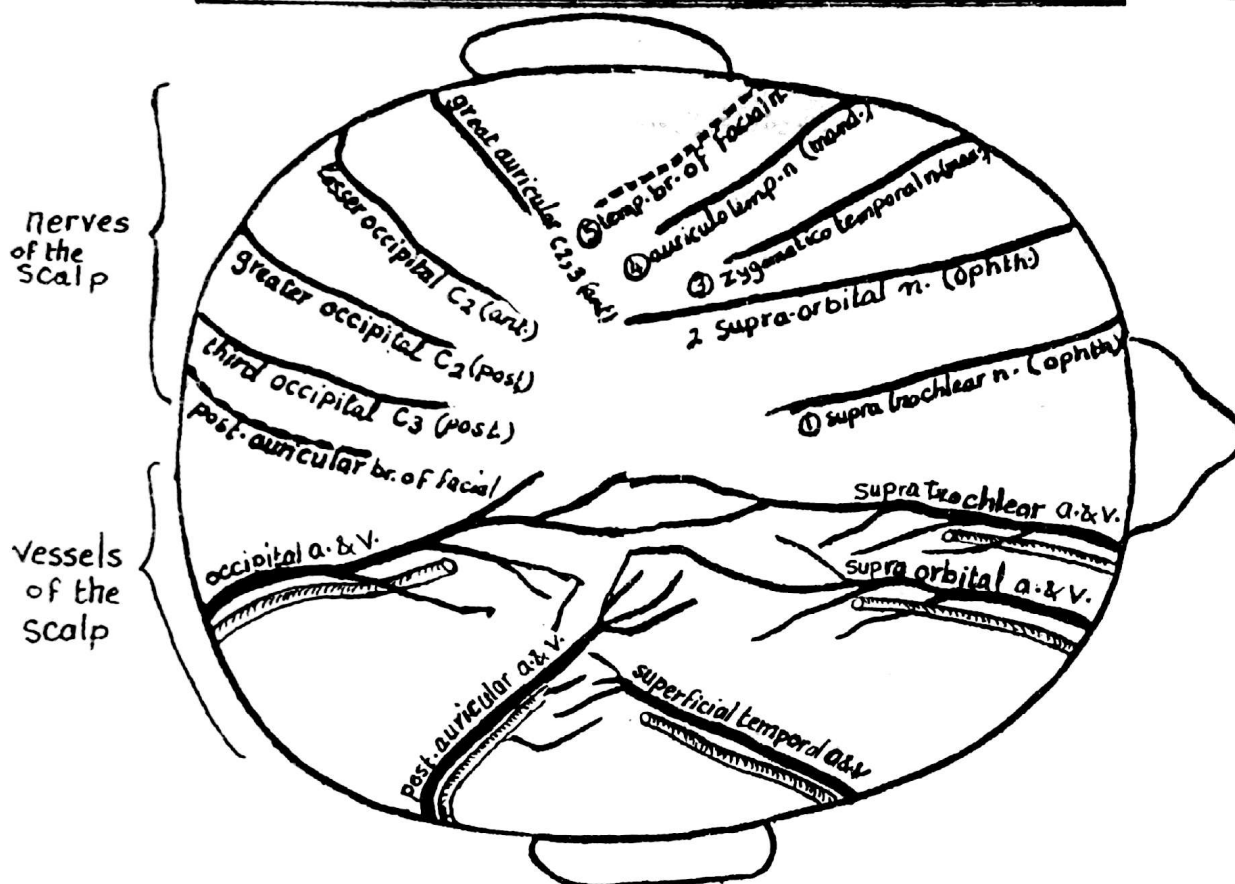
(A) Arteries in front of the auricle :



(1) Supratrochlear a. : arises inside the orbit from ophthalmic a. (br. of I.C.A)

It leaves the orbit (with its nerve) at the sup-orbital margin a finger breadth from middle line & ascends upwards to supply the forehead & scalp.

(2) Supraorbital a. : also arises from ophthalmic a. inside the orbit & leaves the orbit (with its nerve) 2 finger breadth from middle line & ascends upwards to supply the forehead and the ant. part of the scalp.



- 20 nerves supply the scalp (10 on each side)
- 5 nerves (4 Sensory & 1 motor) enter the scalp in front of the auricle on each side.
- 5 nerves (4 Sensory & 1 motor) enter the scalp behind the auricle on each side.

(A) the 5 nerves in front of the auricle 4 Sensory from trigeminal n. 1 motor: from facial n.

(1) Supra-trochlear n. (Sensory) :

- arises from the frontal br. of Ophthalmic n. in the orbit.
- appears with its artery at the Supraorbital margin 1 finger breadth from middle line.
- runs upwards and backwards as far as the coronal suture.
- it supplies : the med. part of upper eye lid, the forehead & the ant. part of the scalp.

(2) Supra-orbital n. (Sensory) :

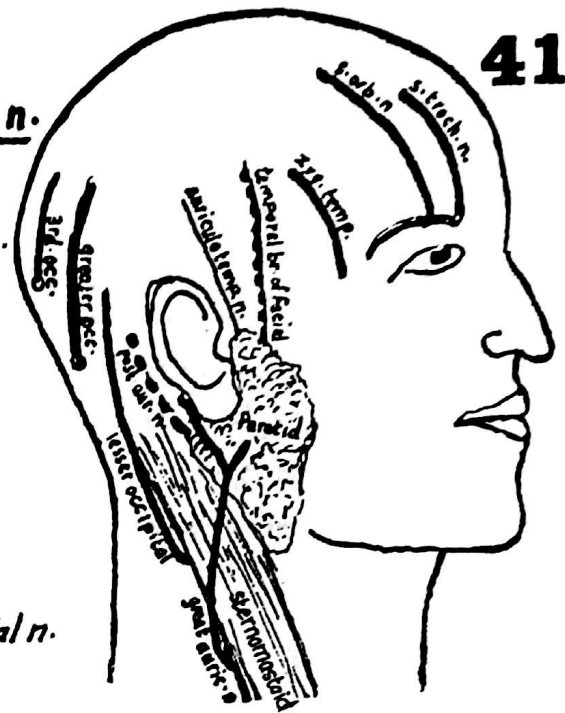
- arises from the frontal br. of Ophthalmic n. in the orbit.
- emerges (with its artery) through the supra orbital notch or foramen 2 fingers from middle line.
- supplies the middle part of upper eye lid then ascends upwards & backwards as far as the lambdoid suture supplying the skin of the forehead & scalp.

(3) Zygomatico-temporal n. (Sensory) :

- arises from the Zygomatic br. of Maxillary n. in the orbit.
- emerges from the Zygomatico-temporal f. to supply the ant. part of the temple.

(4) auriculo-temporal n. (sensory) :

- arises from the post. division of mandibular n.
- appears at the upper end of parotid gland just in front of the auricle & behind superficial temporal vessels.
- supplies the skin of :
 - post. $\frac{1}{2}$ of temporal region.
 - upper $\frac{1}{2}$ of outer surface of the auricle.
 - ant. part of ext. auditory meatus + ear drum.

**(5) temporal br. of facial n. (Motor) :**

- arises as one of the 5 terminal branches of facial n. inside the parotid gland.
- emerges from the upper end of parotid gland in front of superficial temporal vessels.
- runs upwards & forwards to supply : (a) frontal belly of occipito-frontalis m.
(b) upper part of orbicularis oculi m.
(c) auricularis ant. & sup. muscles

**(B) the 5 nerves behind the auricle $\leftarrow$ 4 sensory (from cervical nerves)
1 motor : post-auricular br. of 7****(1) great auricular n. (Sensory) :**

- arises as a branch of the cervical plexus (from ant. rami of C₂, C₃)
- appears at the middle of post. border of sternomastoid m.
- ascends obliquely upwards & forwards on sternomastoid towards the angle of mandible.
- supplies : (a) a small area of skin behind the auricle.
(b) skin of lower $\frac{1}{2}$ of auricle (outer & inner surfaces).
(c) skin over the parotid gland & angle of mandible.

(2) lesser occipital n. (Sensory) :

- arises as a branch of the cervical plexus (from ant. ramus of C₂).
- appears at the middle of the post. border of sternomastoid m.
- ascends upwards along the post. border of sternomastoid towards the mastoid process.
- Supplies the skin of the upper $\frac{1}{2}$ of inner surface of auricle + the adjoining part of scalp.

(3) Greater occipital n. (sensory) : the thickest cutaneous n. in the body :

- it is the post. 1st ramus of C₂.
- appears in the suboccipital triangle and pierces the trapezius m. 1" from median plane.
- supplies the greater part of the back of scalp.

(4) third occipital n. (sensory) :

42

- arises as a small slender br. from post. ramus of C₃ .
- pierces the trapezius muscle close to the median plane .
- supplies the skin over the external occipital protuberance & upper part of back of neck .

(5) Post. auricular br. of facial n. (Motor) :

- arises from the facial n. (after it emerges from the stylomastoid f.)
- runs upwards & backwards behind the auricle .
- supplies the occipital belly of occipitofrontalis + the auricularis post. muscle .

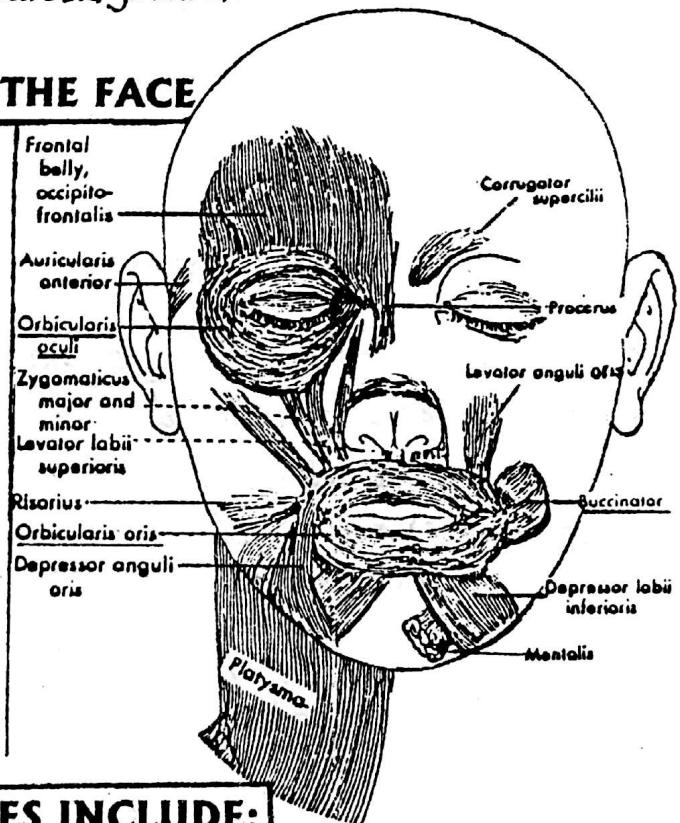
THE FACE

- Skin: elastic, very vascular & rich in sebaceous & sweat glands .
- Superficial fascia : contains numerous muscles, vessels, nerves & fat .
- Deep fascia : is absent except over parotid gland & over buccinator muscle

MUSCLES OF THE FACE

* Characteristics :

- (1) they lie in the superficial fascia .
- (2) they have bony origin .
- (3) they are inserted into the skin (without tendons) .
- (4) they arrange themselves around the openings of the face as 2 groups:
(a) sphincter group & dilator group
- (5) they intermingle with each other .
- (6) they are supplied by facial nerve .



FACE MUSCLES INCLUDE:

3 LARGE MUSCLES

- (1) Buccinator muscle
- (2) Orbicularis oris m.
- (3) Orbicularis oculi m.

MANY SMALL MUSCLES

- Compressor naris & dilator naris
- levator labii superioris
- " " " alaque nasi
- Zygomaticus major & minor
- levator & depressor anguli oris
- risorius, mentalis & other muscles

(1) Buccinator muscle

43

* It is a quadrilateral m. occupying the gap between mandible & maxilla forming the most important part of the cheek.

● Origin : from :

- (1) alveolar margin of maxilla opposite the 3 molar teeth
- (2) alveolar margin of mandible " " " "
- (3) the pterygomandibular lig.

● Insertion:

- (1) upper fibres : inserted into upper lip
- (2) lower fibres : " " lower lip
- (3) middle fibres : decussate at the angle of the mouth : the upper members pass to the lower lip while the lower members pass to the upper lip.

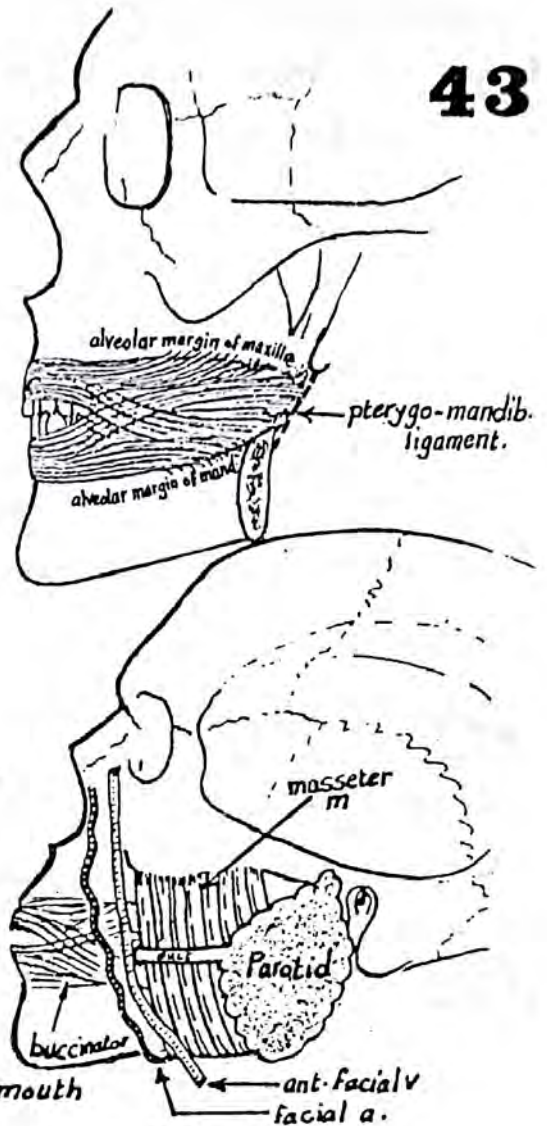
● N. Supply : buccal br. of facial nerve.

● Action:

- (1) prevents the accumulation of food in the vestibule of mouth by keeping the cheeks applied to the gums. It is an accessory muscle of mastication.
- (2) when the cheeks are distended with air the buccinator expels it (used also in wistling & suckling).

● Superficial relations :

- (1) it is covered by the buccopharyngeal fascia & buccal pad of fat
- (2) its post part is overlapped by masseter m. & pierced by the parotid duct (opposite the upper 2nd molar tooth)
- (3) its ant. part is crossed by the facial a. & ant. facial v.



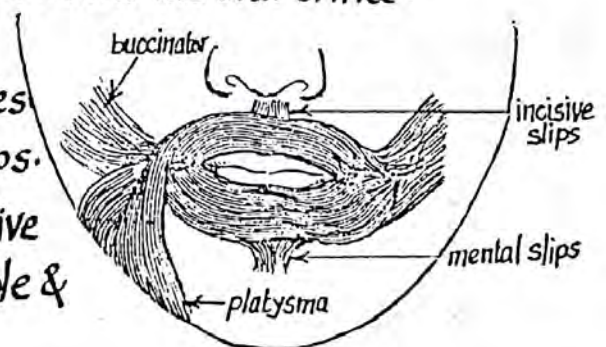
(2) Orbicularis Oris m. (the sphincter of mouth)

* it is a sphincter m. formed of the fibres which surround the oral orifice.

* it consists of :

- (1) Extrinsic fibres : derived of other facial muscles (mainly buccinator) which are inserted into the lips.
- (2) Intrinsic fibres : include mental slips & incisive slips arising from alveolar margin of mandible & maxilla respectively.

* N. Supply : buccal br. of facial nerve.



- * **Action** (1) closes the mouth by bringing the lips close together. **44**
 (2) Compresses the lips against the teeth.
 (3) important for speech (articulation for the letters p. b. m.).
 (4) Kissing !!

(3) Orbicularis Occuli m.

* It is the sphincter of the eye.

* it consists of 3 parts
 orbital
 palpebral
 lacrimal

(a) Orbital part:

- it is the outer thickest part of the muscle which surrounds the orbital margin.

- Origin : From the upper border of the med. palpebral lig. The fibres then curve around the orbital margin.

- Insertion : into the lower border of the med. palpebral lig.

N.B : the med. palpebral lig. extends from the med. angle of the eye to the nasal bone.

(b) Palpebral part : has the same origin & insertion as the orbital part but lies in the substance of the eye lids.

(c) Lacrimal Part : the smallest part :

- origin : From the post-lacrimal crest & the fascia covering the lacrimal sac.

- Insertion : into the margins of the eye lids.

* N. Supply of orbicularis occuli : temporal & Zygomatic branches of facial n.

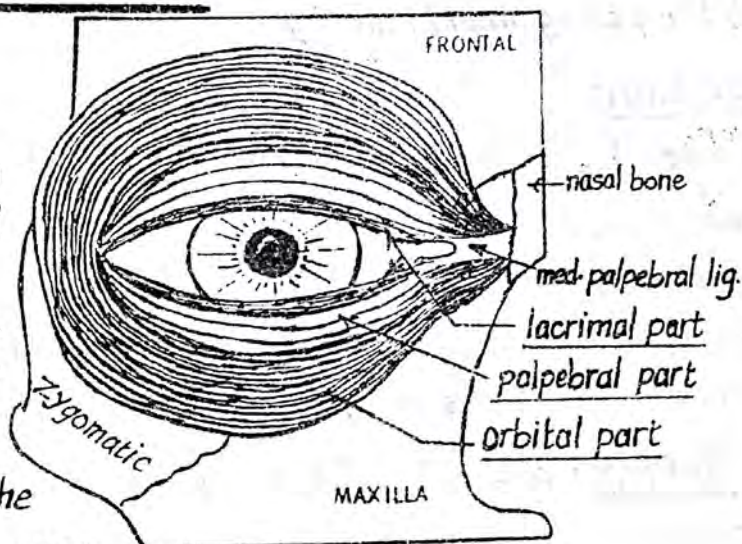
* Action of orbicularis occuli :

(1) the orbital part : closes the eye forcibly (to avoid danger).

(2) the palpebral » : » » » lightly (as in blinking or during sleep).

(3) the lacrimal » : dilates the lacrimal sac (helping the drainage of tears).

(4) the whole muscle : Contracts reflexly to protect the eye against any danger.



(B) SENSORY: (to skin of the face)

- (1) Trigeminal n. (supplies most of the skin).
(2) great auricular n. (C_{2,3}): supplies the skin over the angle of mandible

FACIAL NERVE

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- (3) buccal br.:—emerges from the ant. border of parotid & runs forwards close to the parotid duct towards the angle of the mouth.
—it supplies the buccinator & orbicularis oris muscles.
- (4) marginal mandibular br.: emerges from the ant. border of parotid & runs forwards along the mandible to supply the muscles of the lower lip & chin.
- (5) Cervical br.: emerges from the lower end of parotid gland and passes downwards and forwards below the mandible to supply the platysma muscle.

(B) SENSORY SUPPLY OF THE FACE

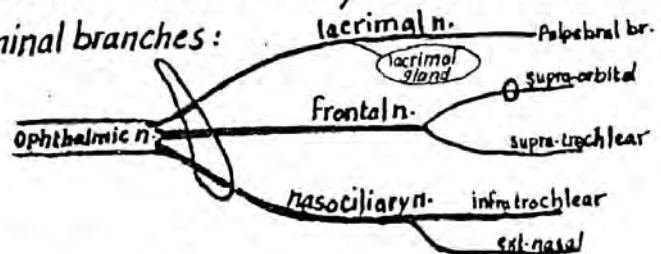
- * The skin of the face is supplied by the 3 divisions of the trigeminal n. (Ophthalmic, maxillary and mandibular nerves).
- * a small area of skin covering the angle of mandible & parotid gland is supplied by the great auricular n. (a branch of the cervical plexus).

(1) Ophthalmic n. (1st branch of trigeminal n.):

- It supplies the forehead, upper eye lids & front of the nose (including its tip)
- the ophthalmic n. gives 3 divisions (lacrimal, frontal & nasociliary nn.) in the orbit which supply the face by the following terminal branches:

(1) palpebral br. of lacrimal n.:

supplies the lat. part of the upper eye lid



(2) Supra-orbital n. (lat. br. of frontal n.)

supplies the skin of the middle part of the upper eye lid + the overlying skin of the forehead.

(3) Supra-trochlear n. (med. br. of frontal n.)

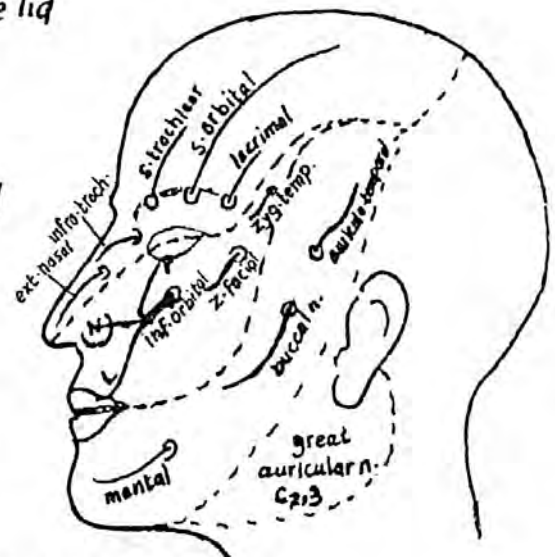
supplies the skin of the medial part of upper eye lid + the overlying skin of the forehead.

(4) Infra-trochlear n. (br. of naso-ciliary n.)

supplies the skin over the bony part of the nose

(5) External nasal n. (br. of nasociliary n.)

supplies the skin over the cartilagenous part of the nose + its tip.



(II) Maxillary n. (2nd branch of trigeminal n.):

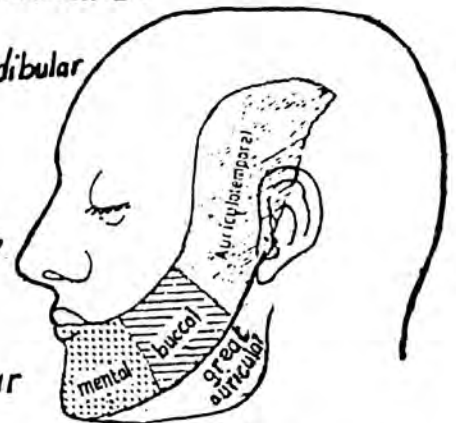
47

- supplies the skin over maxilla including the lower eye lid, side of the nose & the upper lip by the following branches:
- (a) Zygomatico-temporal n.: arises in the orbit & leaves it through the zygomatico-temporal f. to supply the antero-lateral part of the temple.
- (b) Zygomatico-facial n.: leaves the orbit through the zygomatico-facial f. to supply the skin over the zygomatic bone.
- (c) Infra-orbital n. is the termination of the maxillary n. [It reaches the face through the infra-orbital f. where it divides into 3 branches: palpebral, nasal and labial supplying the skin over maxilla including the lower eye lid, side of the nose & upper lip.

(III) Mandibular n. (3rd branch of trigeminal n.):

- Supplies the skin over the mandible by the following branches:

- (1) Auriculo-temporal n. arises from the post. division of mandibular n. & appears at the upper end of the parotid gland. to supply the skin of the post part of side of the face (post. part of temporal region + upper $\frac{1}{2}$ of outer surface of auricle + ant part of ext. auditory meatus).
- (2) Buccal n.: arises from the ant. division of mandibular n. & runs superficial to buccinator m. supplying the skin covering it & the mucous membrane lining it.
- (3) Mental n.: is the termination of the inf. alveolar n. (br. of post. division of mandibular n.). it emerges through the mental f. of mandible to supply the skin of the chin and lower lip.



IV- The great auricular n. (see page 41):

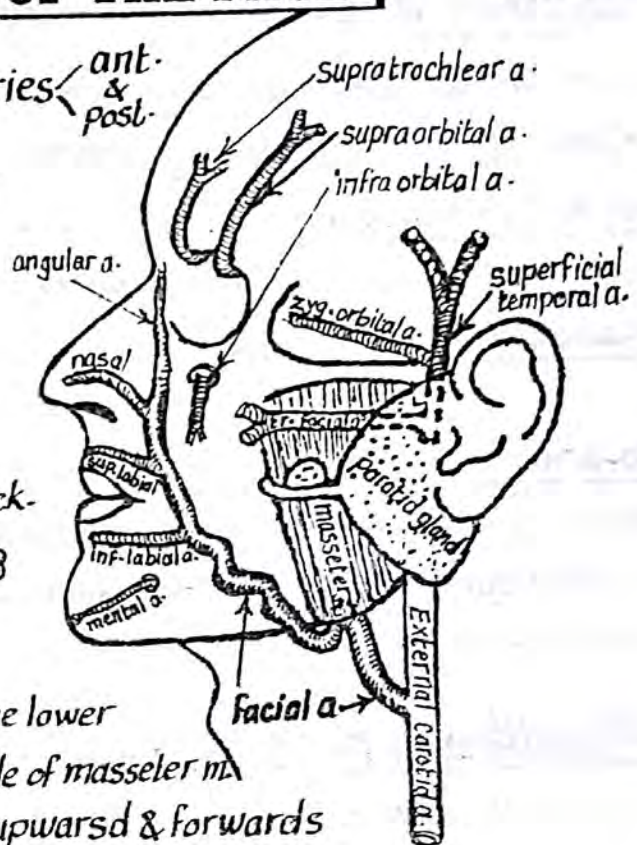
- is a branch of the cervical plexus (from the ant. rami of C₂, C₃)
- It supplies the skin over the angle of mandible & parotid gland.

* The face is supplied by 2 sets of arteries — ant. & post.

(A) Ant. Set of arteries : include:

(1) Facial artery :

- * it is the principal artery of the face.
- * **Origin** : it arises from the ant.-aspect of ext. Carotid a. in the upper part of neck.
- * **Course & relations in the neck** : see p. 133
- * **Course & relations in the face** :
 - it enters the face by winding around the lower border of mandible at the antero-inf.-angle of masseter m.
 - in the face, it runs a tortuous course upwards & forwards in front of the ant.-facial v. first, superficial to buccinator m. till it reaches a point 1 cm. behind the angle of the mouth. then it ascends along the side of the nose to reach the med. angle of the eye.
- * **It ends** at the med.-angle of the eye by becoming the angular a.
- * **Branches in the face** :
 - (1) inf.-labial a. : to the lower lip.
 - (2) sup. labial a. : to the upper lip.
 - (3) nasal a. : to the nose.



(2) **Supra trochlear a.** } arise in the orbit from the ophthalmic a.

(3) **Supra orbital a.** } (br. of int. Carotid a.) : See page 38.

(4) **infra-orbital a.** : it is the continuation of maxillary a. (br. of ext. Carotid a.). It reaches the face through the infra-orbital foramen to supply the cheek.

(5) **mental a.** : it is a br. of inf.-alveolar a. (from maxillary a.). it reaches the face through mental f. & supplies the chin.

(B) Post. Set of arteries :

(1) **transverse facial a.** : (br. of superficial temporal a. inside parotid gland) :

it emerges from the ant.-border of the parotid gland & runs below the zygomatic arch.

(2) **zygomatico-orbital a.** : arises from superficial temporal a. after it emerges from the parotid & runs transversely across the zygomatic arch towards the orbit.

VENOUS DRAINAGE OF THE FACE

49

The face is drained by the following veins:

(1) Anterior facial Vein:

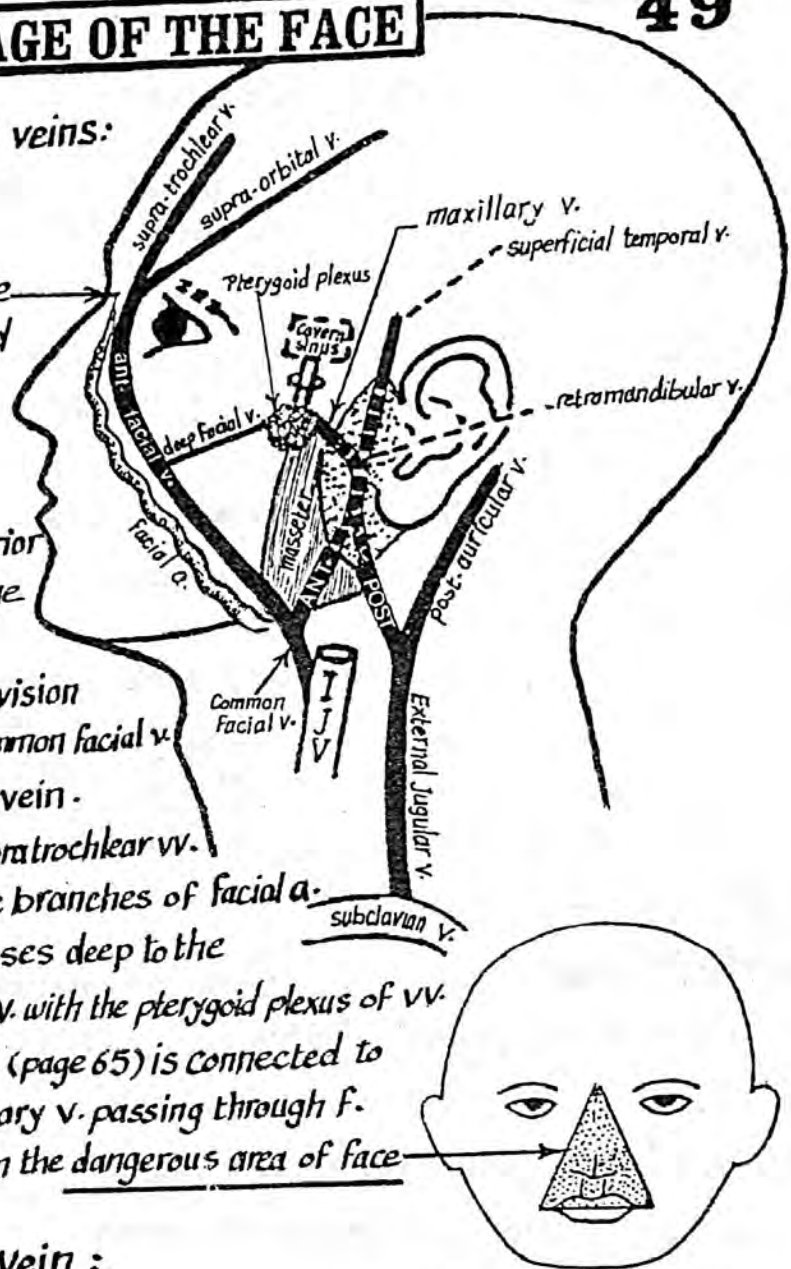
- begins at the med. angle of the eye by the union of the supra-orbital and supra-trochlear veins.
- it runs downwards & backwards behind the facial artery.
- it leaves the face at the antero-inferior angle of masseter m. by piercing the deep fascia.
- it ends by uniting with the ant-division of the retromandibular v. to form common facial v. which ends in the internal jugular vein.
- Tributaries: (1) supra-orbital & supra-trochlear vv.

(2) tributaries corresponding to the branches of facial a.
(3) the deep facial v.: which passes deep to the mandible, connecting the ant-facial v. with the pterygoid plexus of vv.

N.B: the pterygoid plexus of veins (page 65) is connected to the cavernous sinus via an emissary v. passing through f. ovale & may transmit infection from the dangerous area of face to the cavernous sinus.

(2) Retromandibular (post-facial) vein:

- begins: inside parotid gland by the union of 2 veins:
 - (a) maxillary v. (draining the pterygoid plexus of vv.)
 - (b) superficial temporal v.
- it descends inside the parotid gland (deep to the facial n. & its branches).
- it ends at the lower end of the gland by dividing into 2 divisions (ant. & post.):
 - (a) the ant-division: joins the ant-facial v. to form the common facial v. which ends in the I.J.V.
 - (b) the post-division: " " post-auricular v. to form the ext. jugular v. which ends in the subclavian v.



Lymphatic drainage of the scalp & face

- (1) Lymphatics from the back of the scalp drain into the occipital L.Ns.
- (2) " " " side of the scalp " " " parotid L.Ns.
- (3) " " " forehead drain into the submandibular L.Ns.
- (4) " " " side of the face drain into the superficial & deep parotid L.Ns.
- (5) " " " front of the face " " " buccal, submandibular & submental L.Ns.

* Boundaries & Contents : see page 8

MUSCLES OF MASTICATION

* General rules :

- They include 4 muscles : (1) Masseter (2) Temporalis (3) Med. pterygoid (4) Lat. pterygoid.
- Origin : they arise from the temporal & infratemporal fossae.
- Insertion : " all are inserted into the ramus of the mandible.
- N. Supply : " " supplied by the mandibular n.
- Action :
 - (1) all of them elevate the mandible except lat. pterygoid which lowers it.
 - (2) " " " protrude " " " temporalis which retracts it.
 - (3) the pterygoid muscles move the mandible from side to side (chewing).

1- **MASSETER M.**

* It is a quadrilateral m. covering the ramus of mandible

* Origin : it has 2 heads :

(1) superficial head : from lower border of zygomatic arch & adjoining part of zygomatic process of maxilla.
Its fibres pass obliquely downwards & backwards

(2) Deep head : from the inner surface of zygomatic arch. Its fibres pass vertically downwards.

* Insertion :

into the outer surface of the ramus of mandible
(except its posterosuperior part to give space for parotid).

* N. supply : masseteric n. (from ant. division of mandibular n.).

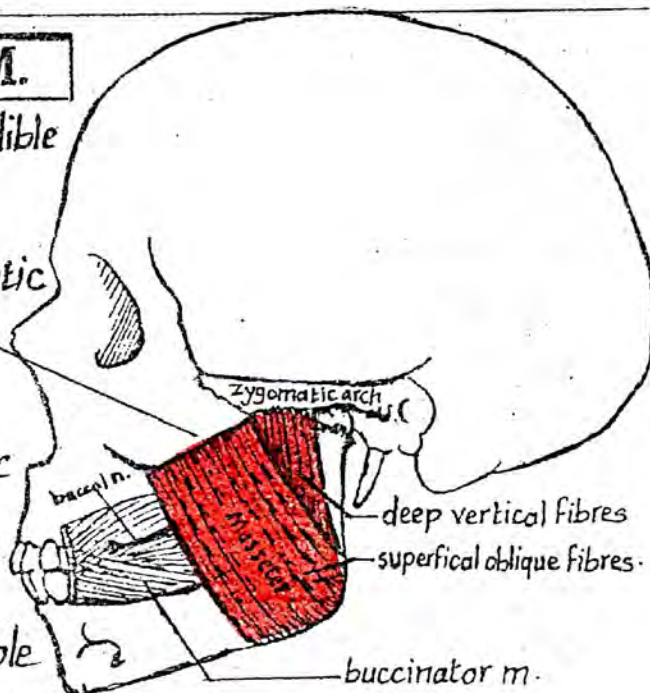
* Action :

- (1) Strong elevator of the mandible e.g. biting (one of the strongest muscles in the body).
- (2) antigravity muscle.
- (3) protrudes the mandible (by the superficial oblique fibres).

* Relations :

(1) deep relations : Buccinator m., Buccal pad of fat & Buccal n.

(2) superficial relations : parotid gland & its duct, brs. of facial n. & transverse facial a.



2- TEMPORALIS M.

51

It is a fan-shaped m. filling the temporal fossa.

Origin:

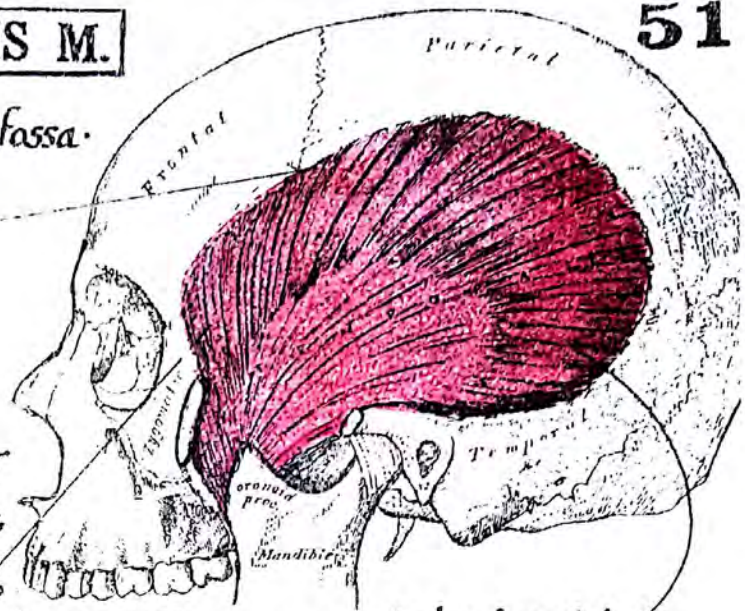
- (1) inferior temporal line.
- (2) floor of the temporal fossa.
- (3) deep surface of the temporal fascia.

Insertion: into tip, ant. border & inner surface of the Coronoid process

- N.B: (1) the ant. fibres are nearly vertical,
 " middle " are oblique while the post. fibres are nearly horizontal.
 (2) the muscle forms a tapering tendon which passes deep to the zygomatic arch to reach its insertion.

*N. Supply: 2 deep temporal nerves from the ant. division of mandibular n.

- *Action: (1) Strong elevator of the mandible } like masseter.
 (2) an antigravity muscle
 (3) retracts the protruded mandible (unlike masseter), by the post. horizontal fibres.



3- MEDIAL PTERYGOID M.

a quadrilateral m. having a small superficial & a large deep head

Origin:

- (1) deep head: from med. surface of lat. pterygoid plate
- (2) superficial head: from maxillary tuberosity

Insertion: med. surface of angle of mandible.

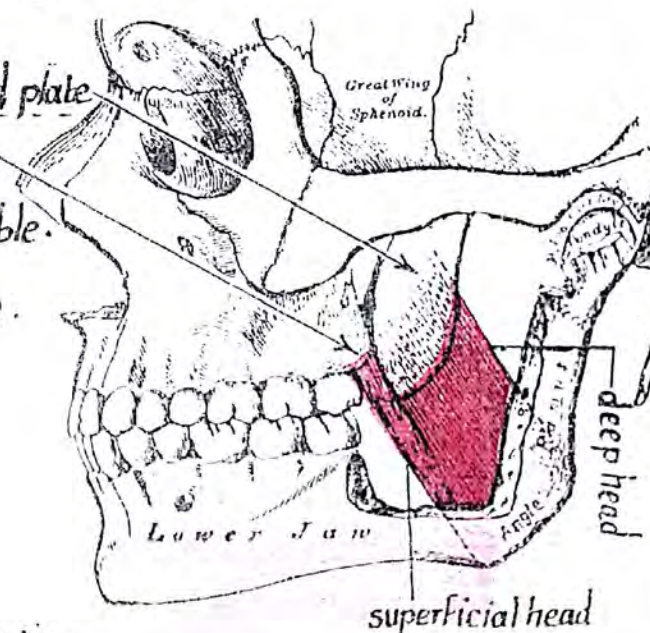
N. Supply: main trunk of mandibular n.

Action:

- (1) side to side movement of the mandible.
- (2) protrusion of the mandible.
- (3) elevates the mandible.

Deep relations:

- (1) tensor palati m.
- (2) sup. constrictor m. of pharynx.
- (3) styloglossus m.
- (4) stylopharyngeus m.



* Short conical muscle having upper & lower heads.

* Origin:

- (1) upper head: infratemporal surface & crest of greater wing of sphenoid
- (2) lower head: lat. surface of the lat. pterygoid plate

* Insertion:

- (1) pterygoid fossa on ant. aspect of neck of mandible
- (2) Capsule & articular disc of the temporomandibular j.

* N. Supply: ant. division of mandibular n.

* Action:

- (1) lowering of the mandible to open the mouth.
- (2) protraction of mandible (when Rt. & Lt. muscles act together).
- (3) protrusion of the mandible to the opposite side (when one muscle act alone).
- (4) side to side movement (when alternating with muscles of the opposite side).

* Relations:

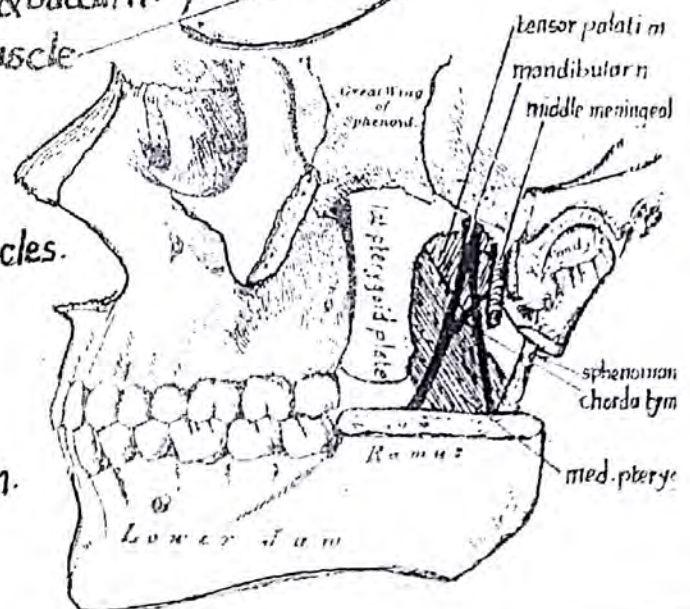
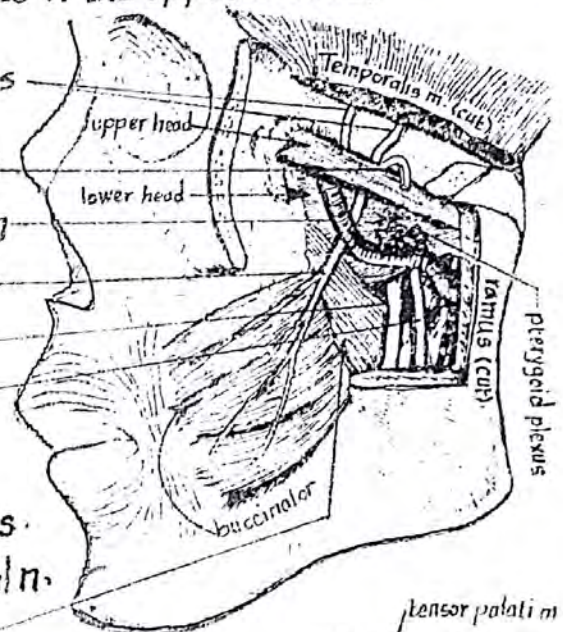
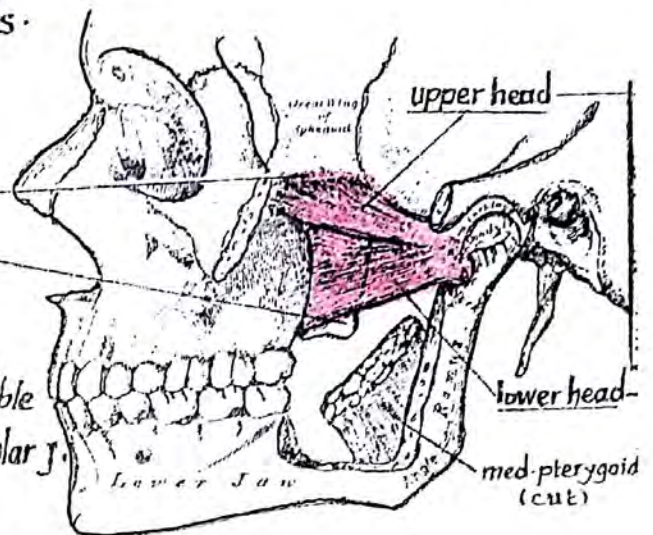
- (1) upper border: related to
 - deep temporal nerves
 - masseteric nerve
- (2) Between the 2 heads
 - maxillary a. dips in
 - buccal n. comes out
- (3) Lower border: related to
 - lingual n.
 - inf. alveolar n.

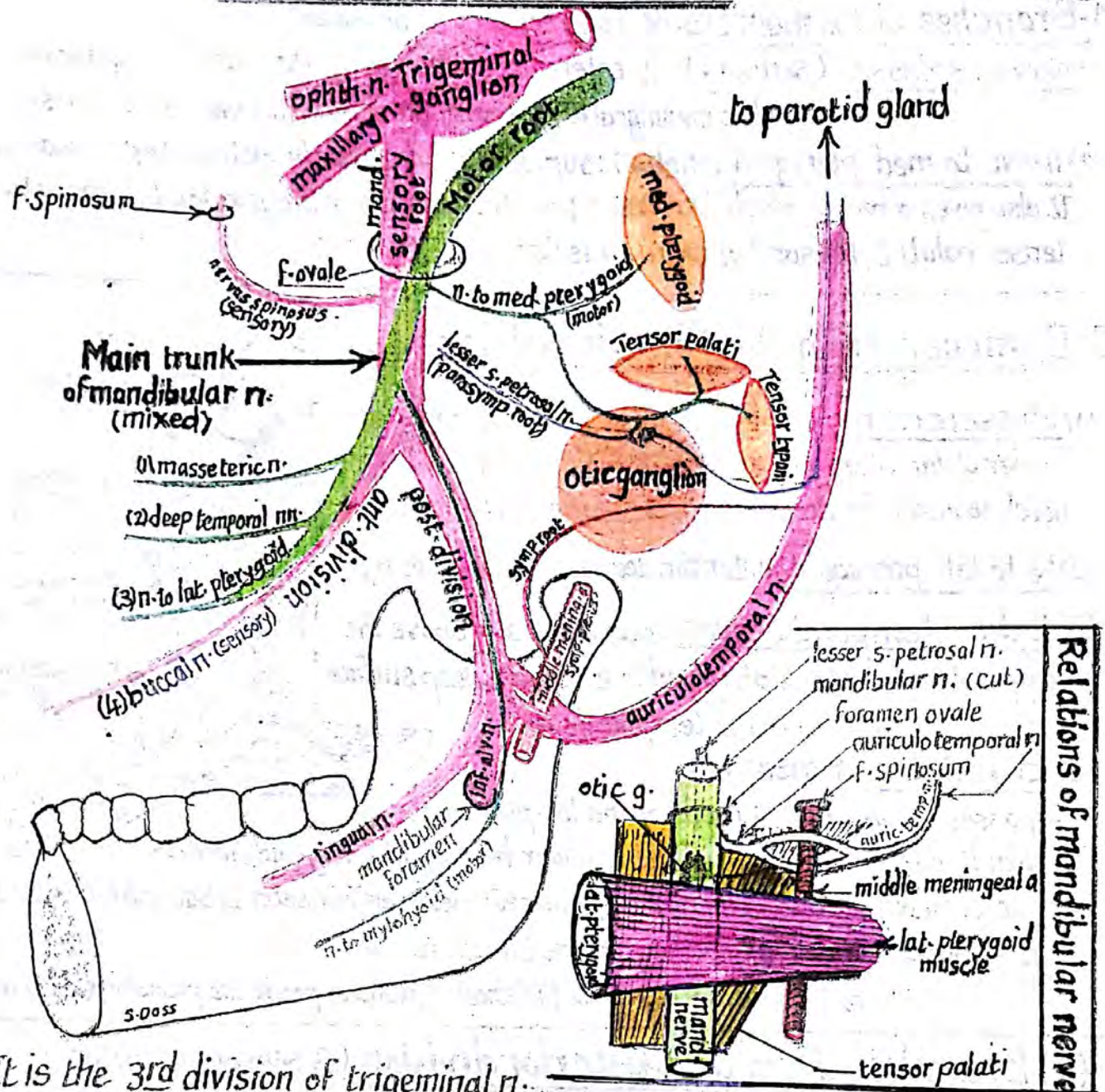
(4) Superficial relations:

- (a) ramus of mandible, masseter & temporalis muscles.
- (b) maxillary a. & pterygoid plexus of veins & buccal n.
- (c) superficial head of medial pterygoid muscle

(5) Deep Relations:

- (a) sphenomandibular ligament.
- (b) med. pterygoid (deep head) & tensor palati muscles.
- (c) middle & accessory meningeal arteries.
- (d) mandibular nerve & its branches.
- (e) chorda tympani n.
- (f) lesser superficial petrosal n. & otic ganglion.





It is the 3rd division of trigeminal n.

* **Origin** : it is a mixed n. Formed of 2 roots :

(a) **Sensory root** : arises from the trigeminal ganglion & runs forwards & laterally towards the foramen ovale

(b) **Motor root** : a smaller root which arises from the trigeminal motor nucleus in the pons & runs deep to the trigeminal ganglion to join the sensory root in the F. ovale

* **Course & Relations** : (see also p. 138)

(1) the 2 roots unite together in the F. ovale to form the main trunk of mandibular n. (mixed).

(2) the main trunk descends through the F. ovale to reach the infratemporal fossa where it is

related :
 laterally to lat. pterygoid m.
 medially to otic ganglion, tensor palati m.
 posterolaterally to middle meningeal a.

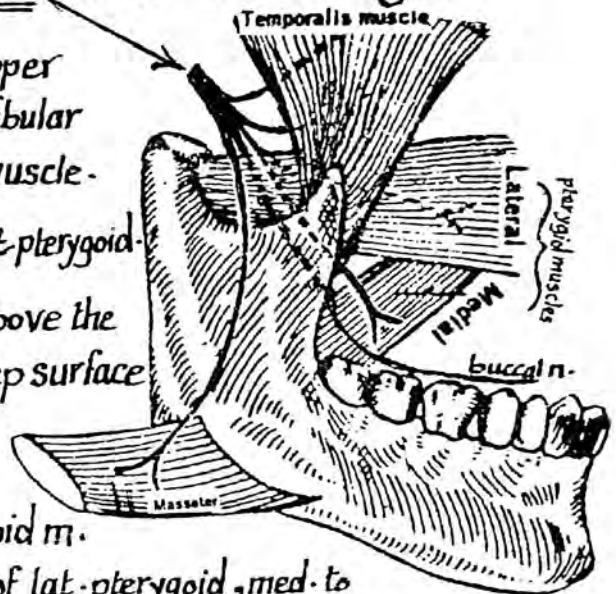
(3) the main trunk gives 2 branches then divides into 2 divisions (small ant. & large post-) about 1/2 cm below the F. ovale.

(A) Branches of the main trunk (one sensory & one motor) :

- (1) nervus spinosus (Sensory) : it enters the cranial cavity through the F. spinosum (with middle meningeal a.) to supply the dura of the middle cranial fossa.
- (2) nerve to med. pterygoid (motor) : supplies this muscle through its deep surface. It also gives a branch which traverses the otic ganglion without relay to supply the tensor palati & tensor tympani muscles.

(B) Branches From the Anterior division (3 motor & 1 sensory) :

- (1) Masseteric n. : passes laterally above the upper border of lat. pterygoid m. then through the mandibular notch to enter the deep surface of the masseter muscle.
- (2) N. to lat. pterygoid : enter the deep surface of lat. pterygoid.
- (3) 2 deep temporal nerves : pass laterally above the upper border of lat. pterygoid to enter the deep surface of the temporalis m.



(4) Buccal n. (sensory) :

- passes between the 2 heads of the lat. pterygoid m.
- then it descends superficial to the lower head of lat. pterygoid, med. to the coronoid process of mandible, to appear between masseter & buccinator muscles.
- it supplies (a) the skin covering the buccinator m.
- (b) the mucous memb. of the cheek & gums opposite the premolar & molar teeth.

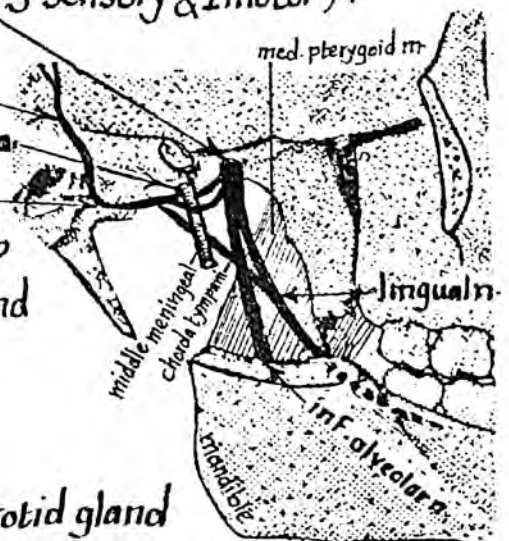
(C) Branches From the Posterior division (3 sensory & 1 motor) :

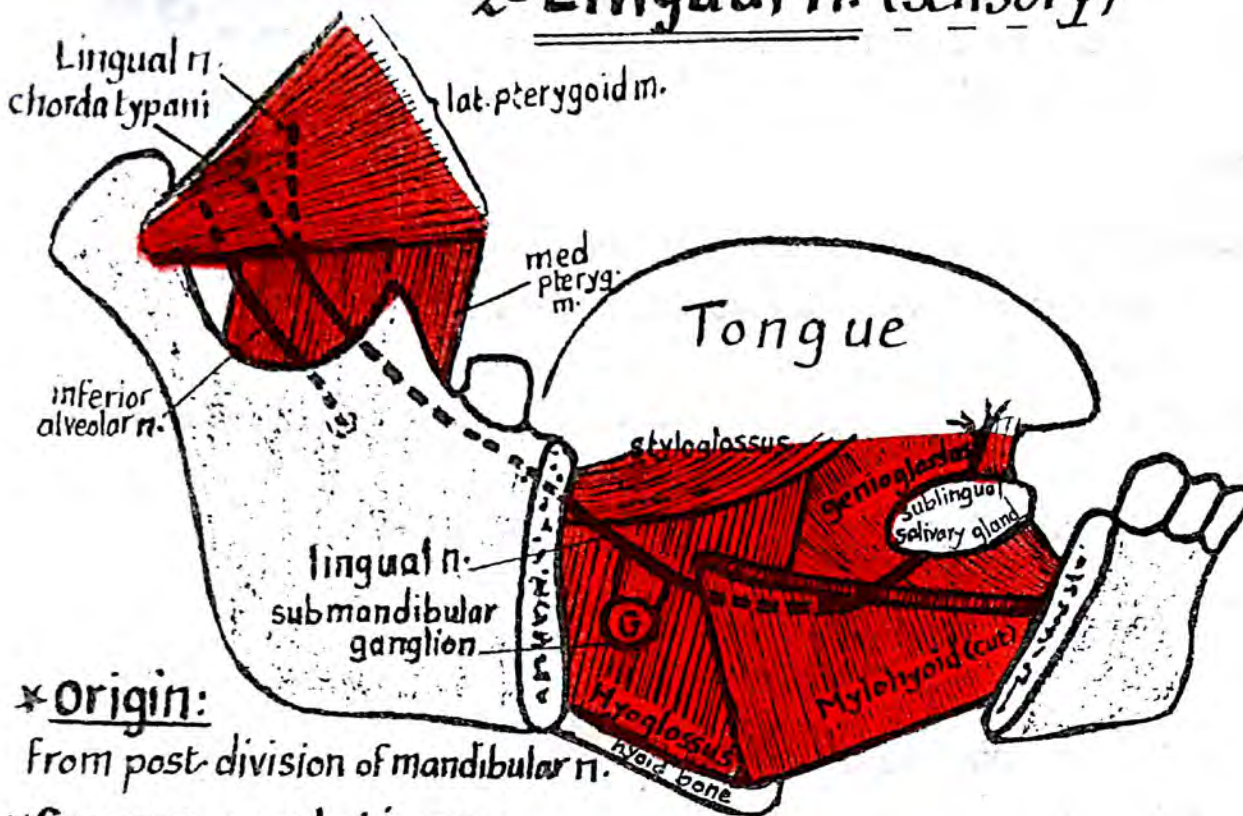
(1) Auriculo-temporal n. (sensory) :

- arises by 2 roots which surround the middle meningeal a.
- passes backwards medial to the neck of the mandible, then behind the temporo mandibular joint, ascends deep to the parotid gland to appear at its upper pole behind the superficial temporal vessels.

- It supplies

- (1) the temporo mandibular joint.
- (2) sensory fibres to the **parenchyma** of the parotid gland
- (3) skin of the upper 2/3 of outer surface of the auricle + scalp above it (temporal region)
- (4) » lining the ext. auditory meatus, tragus of ear + outer surface of the ear drum.
- (5) it carries symp. & parasymp. secretory fibres from the otic ganglion to the parotid gland.



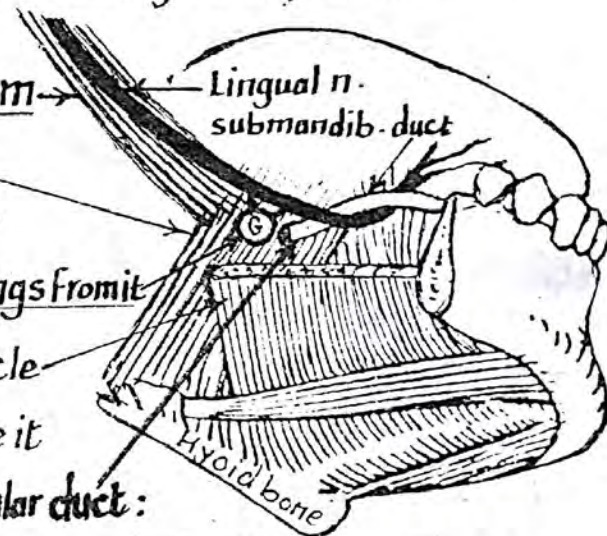


*Origin:

From post-division of mandibular n.

*Course & relations:

- (1) At its origin, it lies deep to the lat. pterygoid m. Here it is joined by the Chorda tympani n. (br. of facial n. carrying taste & parasympathetic fibres).
- (2) It emerges from under cover of the lower border of lat. pterygoid m., in front of the inferior alveolar n.
- (3) then it descends between the ramus of the mandible (superficially) & the med. pterygoid m. (deeply).
- (4) it passes along a groove on the inner surface of the socket of the last molar tooth just under cover of the mucosa of the gum (dangerous position during tooth extraction).
- (5) then it runs superficial to the styloglossus m.
- (6) then it crosses superficial to the hyoglossus m.
Here, the nerve lies deep to the submandibular salivary gland & the submandibular Ganglion hangs from it.
- (7) Finally it passes deep to the mylohyoid muscle & ascends superficial to genioglossus m. Here it has a tripple relation with the submandibular duct:
 - First it passes lat. to the duct,
 - then it curves below " "
 - finally it ascends med. " " "



* **Termination** : it ends by dividing into terminal branches which enter the side of the tongue under its mucous membrane.

* **Distribution** :

- (1) it carries general & taste sensations from the ant. 2/3 of the tongue.
- (2) " " " " sensations from the floor of the mouth & gums.
- (3) " " " " secretomotor parasympathetic fibres from chorda tympani to the submandibular & sublingual glands (relaying first in the submandib. ganglion)

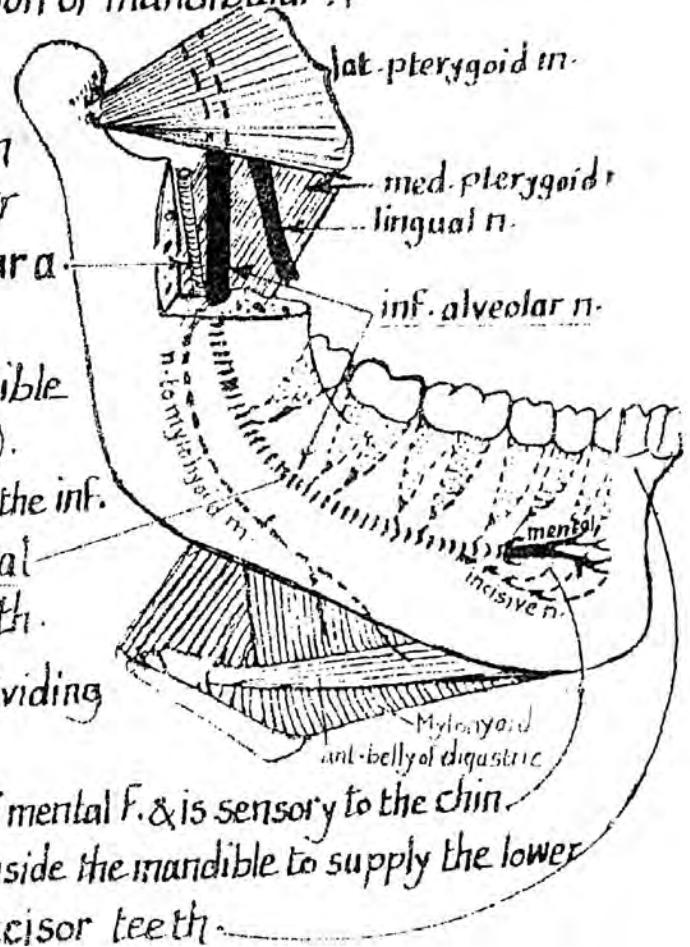
(3) **Inferior alveolar n.** (mixed n. : motor & sensory) :

- It is the largest branch of the post. division of mandibular n.

* **Course & relations** :

- it **begins** deep to the lat. pterygoid m. then emerges from under cover of its lower border where the lingual n. lies in front of it & inf. alveolar a. lies behind it.
- it **descends** between the ramus of the mandible (laterally) & med. pterygoid m. (medially).
- it **enters** the mandibular foramen in front of the inf. alveolar a. & runs in the mandibular canal supplying the lower molar & premolar teeth.
- it **ends** opposite the mental foramen by dividing into 2 branches :

- (a) **mental n.** : comes out of mental F. & is sensory to the chin.
- (b) **incisive n.** : continues inside the mandible to supply the lower canine & incisor teeth.



(4) **N. to mylohyoid** (motor) :

- it **contains** all of the motor fibres of the post. division of mandibular n.
- it **arises** as a br. of the inf. alveolar n. before it enters the mandibular F.
- it **runs** in the mylohyoid groove on the inner surface of ramus of mandible
- it **ends** by supplying the Mylohyoid m. + ant. belly of digastric m.

(4) Nerve to Mylohyoid m. (motor)

57

- it arises as a branch from the inf. alveolar n. before it enters the mandibular f.
- it runs in the mylohyoid groove of the mandible.
- it ends by supplying the mylohyoid m. + the ant. belly of digastric m.

OTIC GANGLION

- * **Type**: it is a small parasympathetic ganglion which lies close to the mandibular n. but it is related functionally to the glossopharyngeal n.
- * **Site**: in the infratemporal fossa just below foramen ovale.
- * **Relations**:
 - medially: tensor palati m.
 - laterally: main trunk of mandibular n.
 - posteriorly: middle meningeal a.

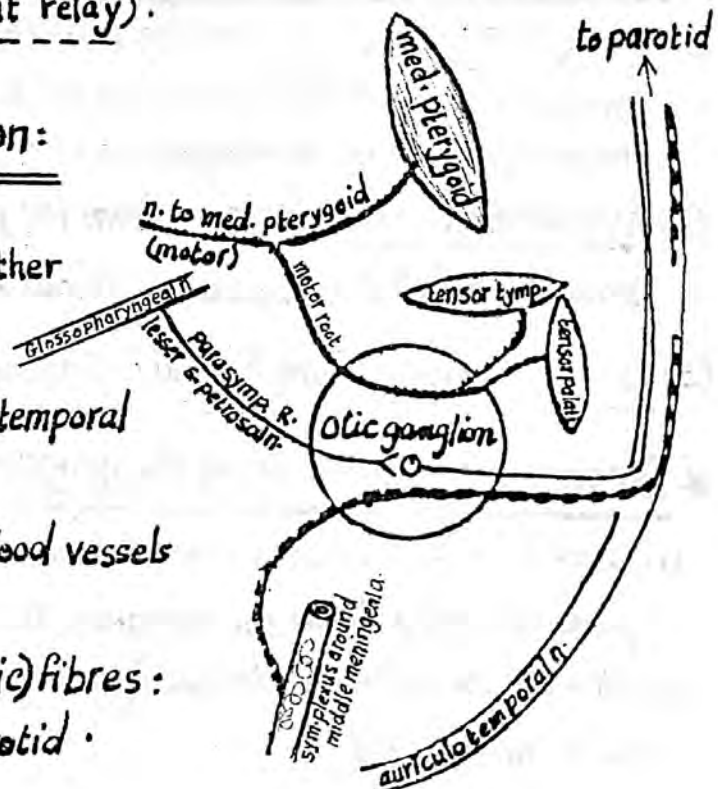


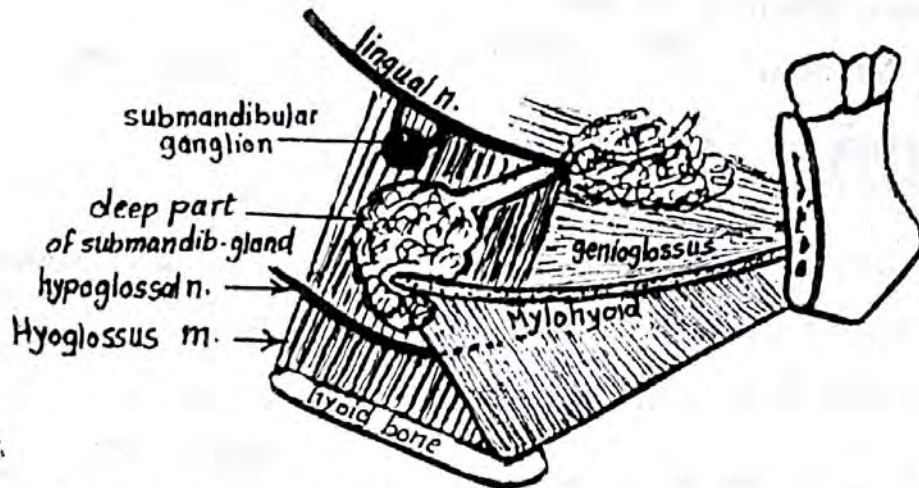
* Roots entering the ganglion:

- (1) Motor root: arising from n. to med. pterygoid (passes without relay).
- (2) Parasympathetic root (and possibly sensory root): formed by the lesser superficial petrosal n. which carries preganglionic parasymp. from the glossopharyngeal n. (Relays in the ganglion).
- (3) Sympathetic root: derived from the plexus around middle meningeal a. (passes without relay).

* Branches Coming from the ganglion:

- (1) Motor twig to tensor palati m. & another twig to tensor tympani m.
- (2) A Communicating branch to auriculo-temporal nerve: this branch is formed of:
 - (a) sympathetic fibres to supply the blood vessels of parotid gland.
 - (b) parasympathetic (post. ganglionic) fibres: secretomotor to parotid.





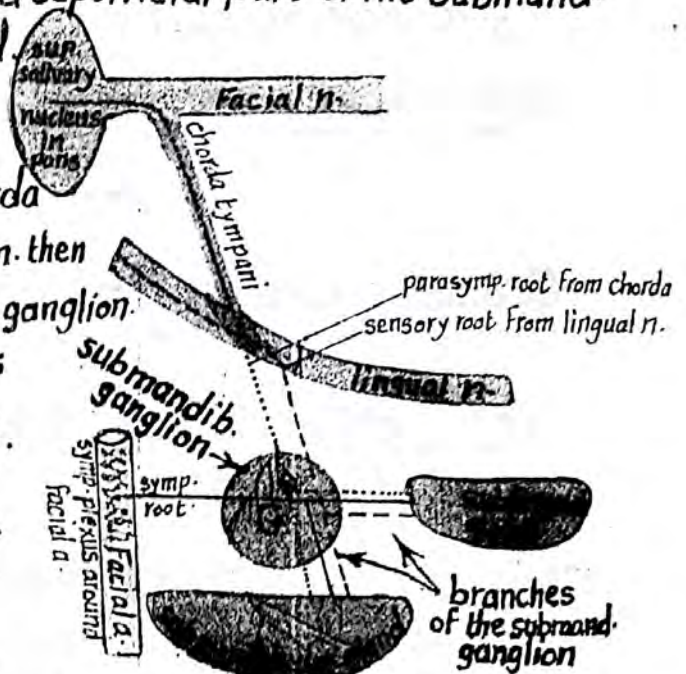
- * **Type** : it is a small parasympathetic ganglion (2-3 mm. in diameter).
- * **Site** : it lies in the submandibular region on the upper part of hyoglossus m., suspended from the lingual n. by 2 roots.
- * **Relations** : (1) superiorly : lingual n.
 (2) inferiorly : deep part of submandibular gland & its duct.
 (3) medially : hyoglossus m.
 (4) laterally : mylohyoid m. & superficial part of the submand. salivary gland.

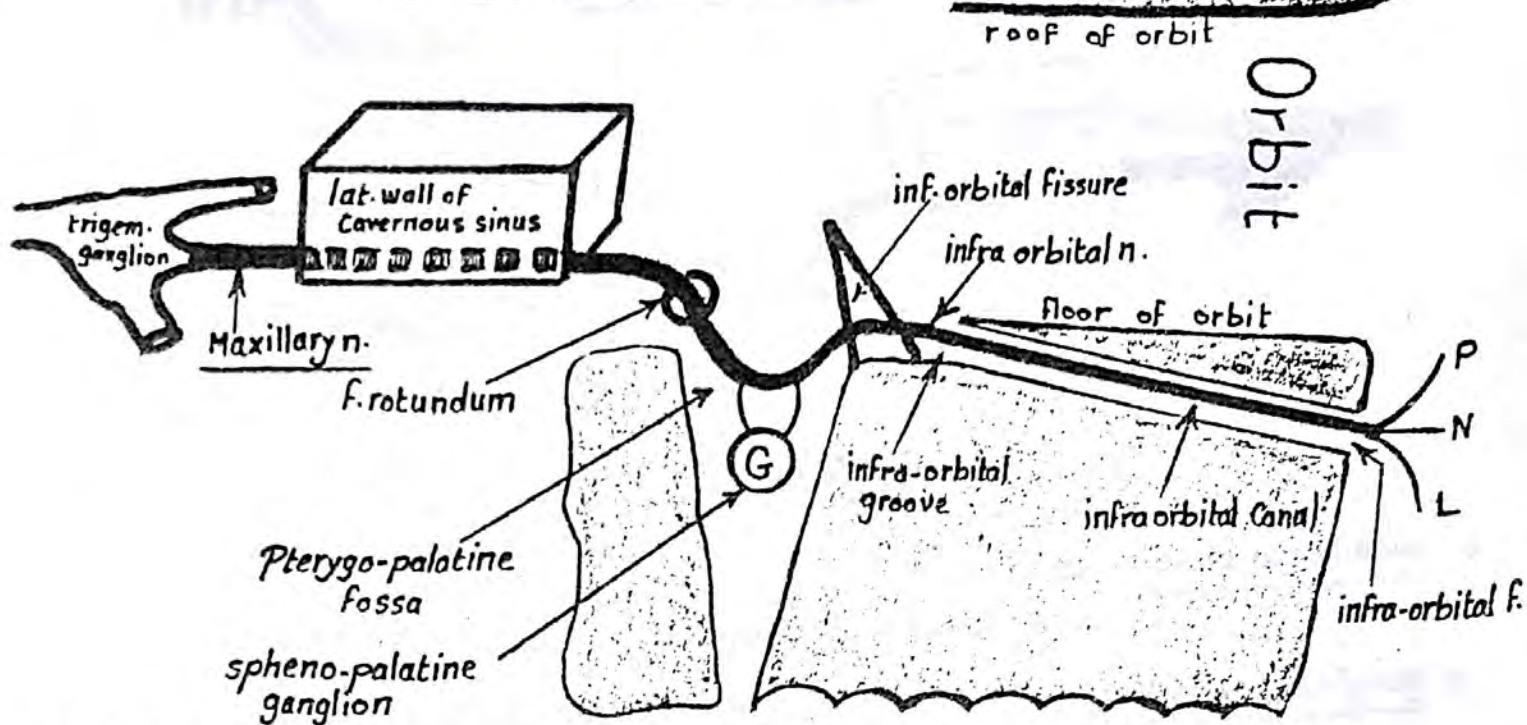
* Roots entering the ganglion:

- (1) **Parasympathetic root** : arising from the chorda tympani (br. of facial n.). It joins the lingual n. then the para symp. fibres leave lingual n. to relay in the ganglion.
- (2) **Sympathetic root** : arising from the plexus around facial a. (it passes without relay).
- (3) **Sensory root** : from lingual n. (no relay).

* Branches arising from the ganglion:

- (1) several small branches (mixed, sensory + symp. + parasympathetic fibres) pass directly from the ganglion to supply the submandibular salivary gland.
- (2) similar branches to the sublingual salivary gland join the lingual n. to reach the gland.





* **Origin:** it arises as the 2nd division of the trigeminal ganglion.

* **Type:** purely sensory nerve

* **Distribution:** its sensory fibres supply: { (1) the maxillary area of skin of face.
(2) the maxillary teeth (of the upper jaw).
(3) the mucous membranes related to maxilla

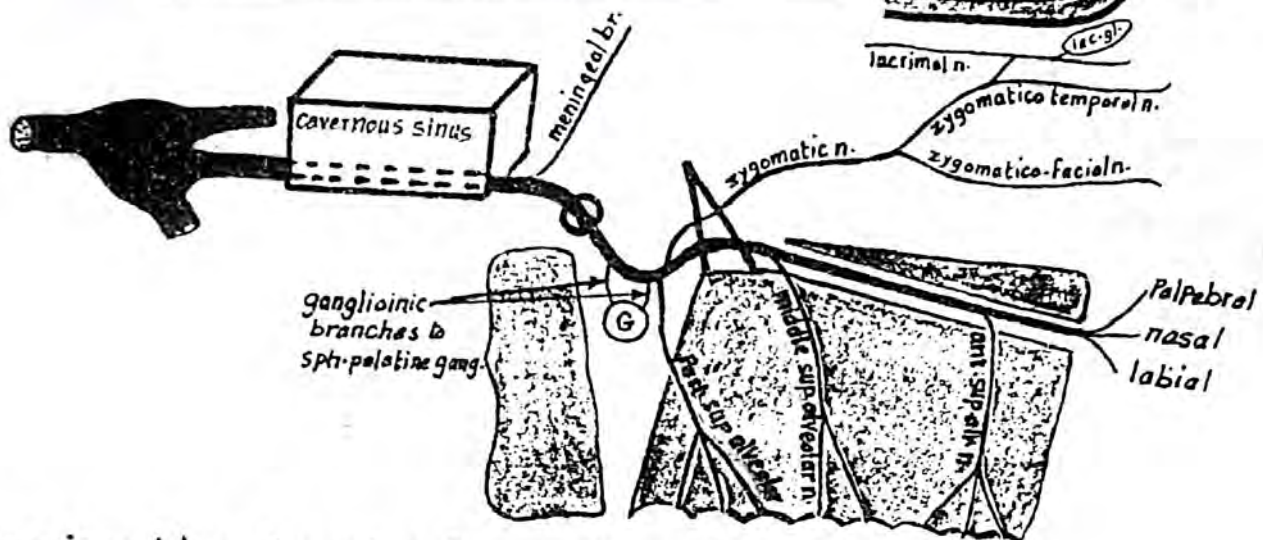
* Course & Relations:

- (1) it arises as the 2nd branch of the trigeminal ganglion.
- (2) it passes forwards in the lower part of lat. wall of the Cavernous sinus.
- (3) then it leaves the cranial cavity by passing through the foramen rotundum.
- (4) it reaches the pterygopalatine fossa where it gives 2 sensory roots to the sphenopalatine ganglion.
- (5) finally it enters the orbit through the inferior orbital fissure to become the Infra-orbital Nerve.
- (6) the infra-orbital n. traverses the floor of the orbit lying first in the infra-orbital groove then infra-orbital Canal to reach the face through the infra-orbital Foramen.

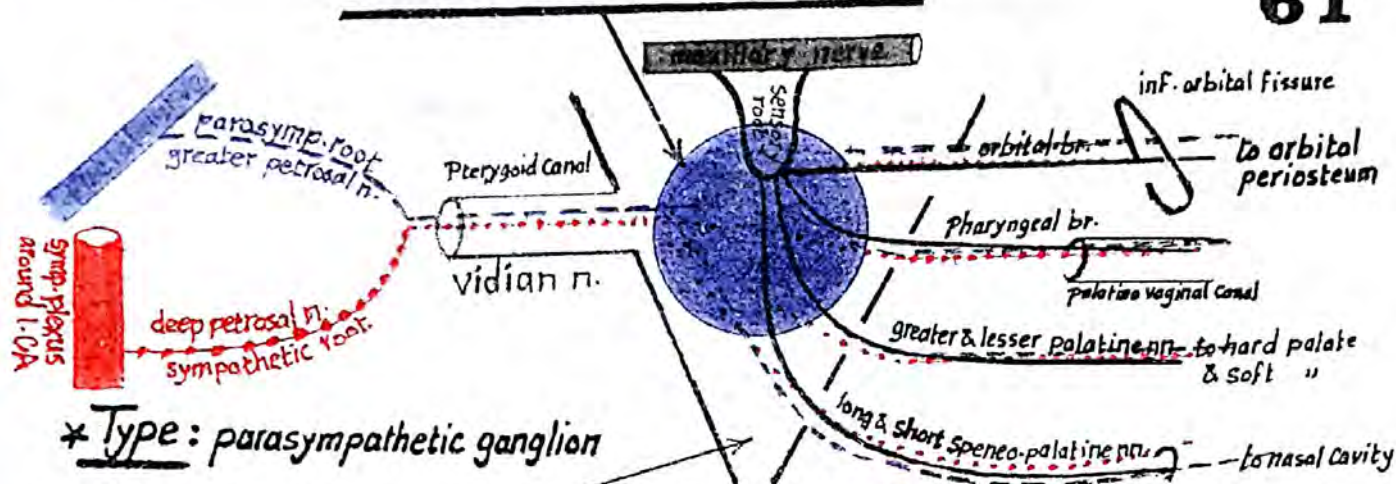
* **Termination:** the infra-orbital n. ends in the face by dividing into 3 branches: { (1) palpebral.
(2) nasal.
(3) labial.

BRANCHES OF MAXILLARY N.

60



- (1) meningeal branch: - arises from maxillary n. in the cranial cavity.
- it supplies the dura mater of the middle cranial fossa.
- (2) ganglionic branches: - arise in the pterygo-palatine fossa & are 2 in number.
- they carry sensory fibres to the sphenopalatine ganglion.
- (3) Zygomatic nerve: - arises in the pterygopalatine fossa.
- it enters the orbit through the inf. orbital fissure.
- it divides in the lat. wall of the orbit into 2 branches:
 - (a) Zygomatico-facial n.: reaches the face through the z. facial foramen & supplies the skin over the zygomatic bone.
 - (b) Zygomatico temporal n.: communicates with the lacrimal n. (delivering to it postganglionic secretomotor fibres to lacrimal gland) then reaches the face through the zygomaticotemporal f. to supply the skin of the temporal region.
- (4) Post. sup. alveolar n.: - arises in the pterygopalatine fossa then passes through the pterygomaxillary fissure
- it enters the post. sup. alveolar f. on the back of maxilla to supply the mucous memb. of the maxillary air sinus + the upper 3 molar teeth & gum.
- (5) middle sup. alveolar n.: - arises in the infraorbital groove.
- it descends along the lat. wall of maxillary sinus to supply the upper 2 premolar teeth + the gum.
- (6) ant. sup. alveolar n.: arises in the infraorbital canal & descends in the ant. wall of maxillary sinus to supply the upper 2 incisors & canine teeth + the gum.
- (7) Terminal branches in the face: palpebral, nasal & labial : see page 47



* Type : parasympathetic ganglion

* Site : it lies in the pterygopalatine fossa suspended from maxillary n. by 2 roots but functionally related to the facial n.

* Size : it is the largest parasympathetic ganglion (4-5 mm. in diameter).

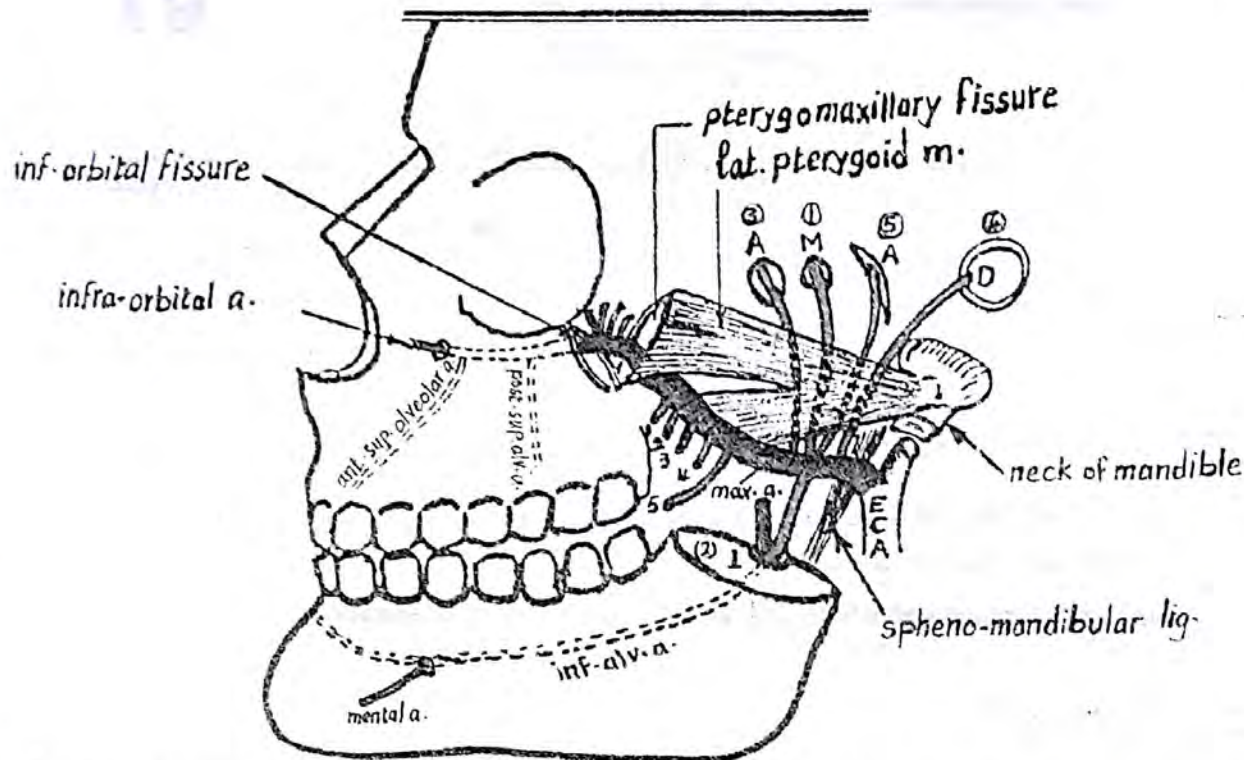
* Roots entering the ganglion :

- (1) Sensory root : 2 sensory branches arising from the maxillary n. (no relay in the ganglion).
- (2) Sympathetic root : the deep petrosal n. derived from the sympathetic plexus around the internal carotid a. (no relay in the ganglion).
- (3) parasympathetic root : the greater superficial petrosal n. (branch from facial n.) : it relays in the ganglion.

N.B : the deep petrosal n. (sympathetic) unites with the greater s. petrosal n. (parasymp) to form the n. of pterygoid canal (Vidian n.) which passes through the pterygoid canal to reach the ganglion in the pterygopalatine fossa.

* Branches of the ganglion :

- (1) Orbital branches : enter the orbit through the inf. orbital fissure. They supply the orbital periosteum & the mucous memb. of the sphenoidal air sinus.
- (2) Pharyngeal branch : pass through the palatino-vaginal canal to reach the nasopharynx. It supplies the mucous memb. of nasopharynx & the opening of Eustachian tube.
- (3) greater palatine n. : passes through the greater palatine canal → greater palatine foramen. It supplies the mucous membrane of the hard palate + part of the nose.
- (4) Lesser palatine n. : passes through the lesser palatine canal → lesser palatine foramen to supply the mucous memb. of the soft palate & the palatine tonsil.
- (5) Long sphenopalatine n. : passes through the sphenopalatine f. to reach the nasal cavity to supply mucous memb. of nasal septum. It also supplies the ant. part of hard palate.
- (6) Short sphenopalatine n. : passes through the sphenopalatine f. to reach the nose supplying the m. memb. of upper part of lat. wall of the nose.



***Origin:** it arises within the substance of parotid gland, deep to the neck of mandible, as the larger of the 2 terminal branches of Ext. Carotid artery.

***Course & relations:** the Course of the artery is divided into 3 parts:

- (1) First part : runs forwards within the parotid gland between the neck of mandible & the spheno-mandibular lig. along the lower border of post-part of lat. pterygoid m.
- (2) Second Part : runs upwards & forwards along the lat. surface of lower head of lat. pterygoid m. Covered laterally by temporalis m.
- (3) Third part (pterygopalatine a.) : dips between the 2 heads of lat. pterygoid m. then passes through the pterygomaxillary fissure to reach the pterygo-palatine fossa.

***Termination:** the maxillary a. ends by becoming the Infra-orbital a. which enters the orbit through the inf. orbital fissure then runs along the floor of the orbit in the infra orbital groove then infra orbital Canal accompanied by the infra orbital n. (Continuation of maxillary n.).
- the infra orbital a. finally reaches the face through the infra orbital foramen.

I-Branches from the 1st part: (M.I.A.D.A)

the 1st part gives 5 branches passing through bony foramina

(1) middle meningeal a.

- 1 - It passes upward & medially between lat. pterygoid m. laterally & the tensor tympani m. medially.
- 2 - then it passes between the 2 roots of the auriculo temporal n.
- 3 - it enters the f. spinosum to reach the middle Cranial fossa.
- 4 - In the Cranial cavity, it runs forwards & laterally on the

greater wing of sphenoid (embedded in the outer layer of dura & grooving the inner surface of the bone).

5 - about 2 cm. from the f. spinosum, it ends by dividing into 2 branches < anterior
posterior



(A) The ant. branch: (larger & more important):

- passes upwards & forwards in a groove (or even canal) on the inner surface of the greater wing of sphenoid till it reaches the Pterion.
- then it curves upwards & backwards on the inner surface of parietal bone.

N.B - the course of the ant. branch lies opposite the motor area in the precentral gyrus of the brain hence haemorrhage from this artery may press on this area.

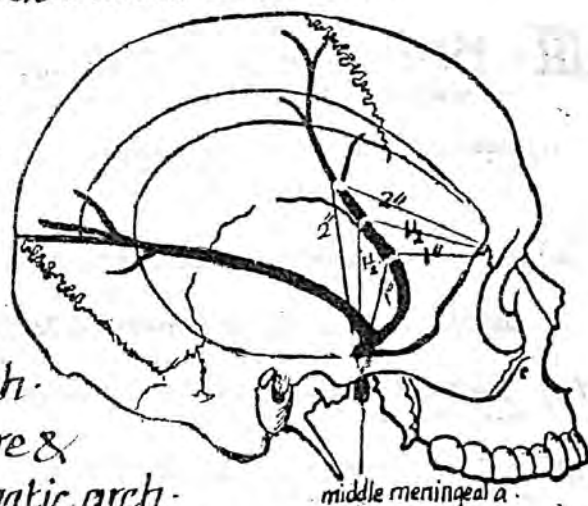
(B) The post. branch: runs upwards & backwards towards the lambda.

*Surface anatomy of the M.M.A:

(1) The main trunk: enters the skull at a point just above the middle of the zygomatic arch & runs vertically upwards for 2 cm.

(2) The ant. branch: passes along 3 points:

- (a) a point 1" behind the frontozygomatic suture & 1" above the midpoint of the zygomatic arch.
- (b) point $1\frac{1}{2}$ " behind the frontozygomatic suture & $1\frac{1}{2}$ " above the midpoint of the zygomatic arch.
- (c) point 2" behind the frontozygomatic suture & 2" above the midpoint of zygomatic arch.



(3) The post. branch: represented by a horizontal line from the point of division of the M.M.A to the lambda.

N.B: both brs. of M.M.A supply:

- (a) inner table of the skull bones & dura mater
- (b) Trigeminal ganglion
- (c) sup. tympanic a.: runs in the canal for tensor tympani supplying its mucosa & tensor tympani.
- (d) anastomotic br.: enters the sup. orbital fissure to anastomose with the lacrimal a.

2- Inferior Alveolar a.

64

- * runs downwards behind the inf. alveolar n.
- * gives the mylohyoid a. then enters the mandibular foramen & runs in the mandibular canal
- * it ends opposite the 3rd molar tooth by dividing into 2 branches
 - (a) mental br. which emerges from the mental f. to supply the chin.
 - (b) incisor br. which continues in the mandibular canal to supply the lower teeth.

3- Accessory meningeal a.

enters the skull through the f. ovale to supply the dura mater

4- Deep auricular artery

- enters the ext. auditory meatus between the cartilagenous & the bony parts.
- it supplies the ext. auditory meatus + the outer layer of the ear drum.

5- Anterior tympanic a.

- enters the middle ear cavity through the squamotympanic fissure

II- Branches of the 2nd Part of Maxillary a. :

it gives 5 muscular branches

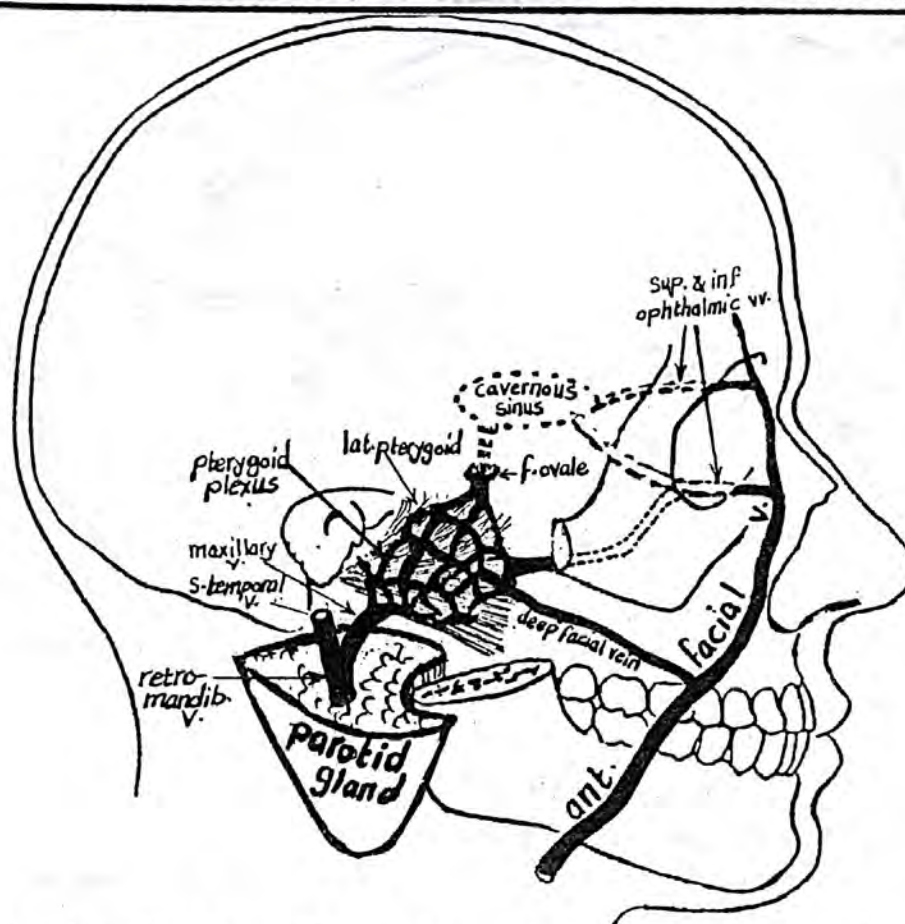
- (1) masseteric a. to masseter m. (2) deep temporal arteries to temporalis m.
- (3) branches to lat. pterygoid m. (4) branches to med. pterygoid m.
- (5) buccal a. which accompanies the buccal br. of mandibular n. on buccinator m.

III- Branches of the 3rd Part of Maxillary a. :

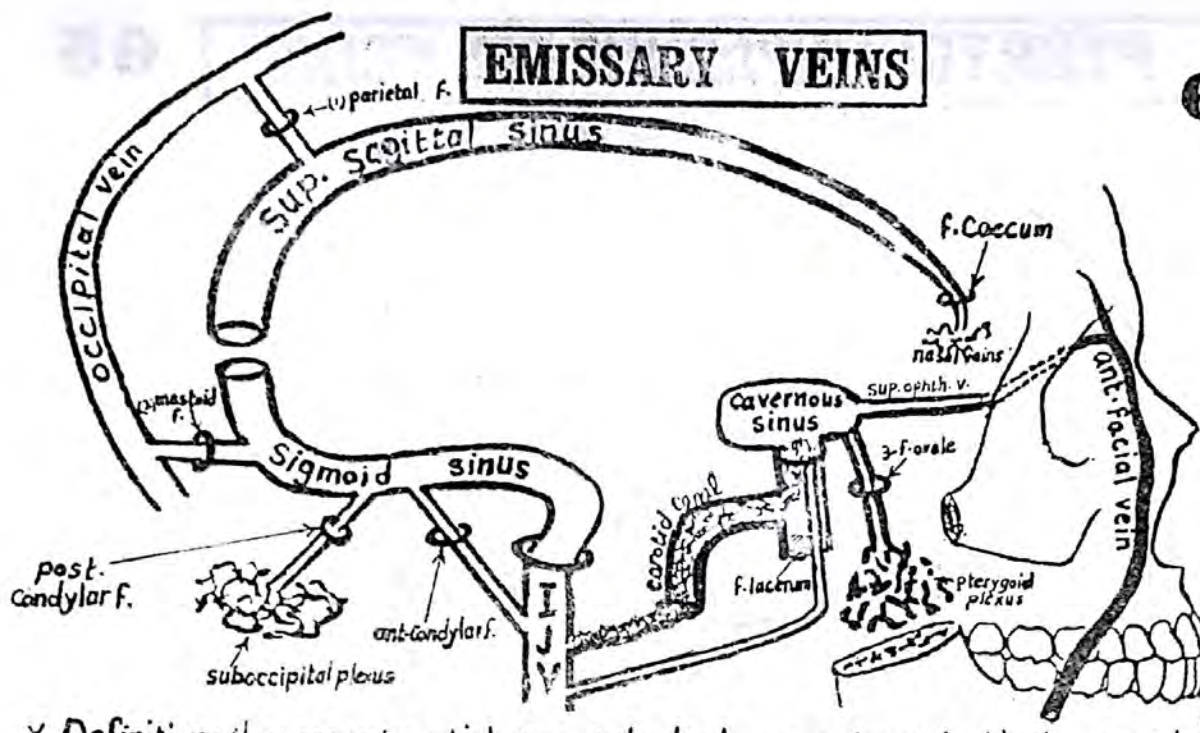
- (1) post. superior dental (alveolar) a. which enters the back of maxilla to supply the molar & premolar teeth.
- (2) greater palatine a. : accompanies the corresponding n. & descends through the greater palatine canal → gr. palatine foramen to reach the hard palate.
- (3) 2-3 lesser palatine aa. : → lesser palatine foramina to supply soft palate & tonsil.
- (4) sphenopalatine a. : reaches the nose through the sphenopalatine foramen.
- (5) pharyngeal br. : very small a. which passes through the palato vaginal canal to reach the pharynx.
- (6) artery of pterygoid canal : passes with the corresponding n. & reaches the nasopharynx.

IV- Branches from the infra-orbital a. :

- (1) orbital branches : supplying the contents of the orbit.
- (2) ant. sup. dental a. : supplying the canine & incisor teeth.
- (3) terminal branches in the face : palpebral, nasal & labial.



- * Site : it is a network of veins lying around & inside the substance of lat. pterygoid m.
- * Formation : it is formed by the veins accompanying the branches of maxillary a.
- * drainage : the plexus is drained posteriorly by the maxillary v. which ends inside the parotid gland by uniting with the superficial temporal v. to form the retromandibular (post-facial) vein.
- * Communications of the pterygoid plexus :
 - (1) it communicates with the ant. facial v. through the deep facial v. which passes deep to the ramus of the mandible.
 - (2) it communicates with the Cavernous sinus via emissary veins passing through the f. ovale or sphenoidal emissary f. & through the f. lacerum.
 - (3) Communicates with the inf. ophthalmic v. via a communicating v. passing through the inf. orbital fissure.
- * Clinical importance : infection in the face may reach the pterygoid plexus of vv. then it can pass to the cranial cavity via emissary veins causing Cavernous sinus thrombosis.



* **Definition:** they are veins which connect the dural venous sinuses inside the cranial cavity with the veins outside the skull.

* **Characters:**

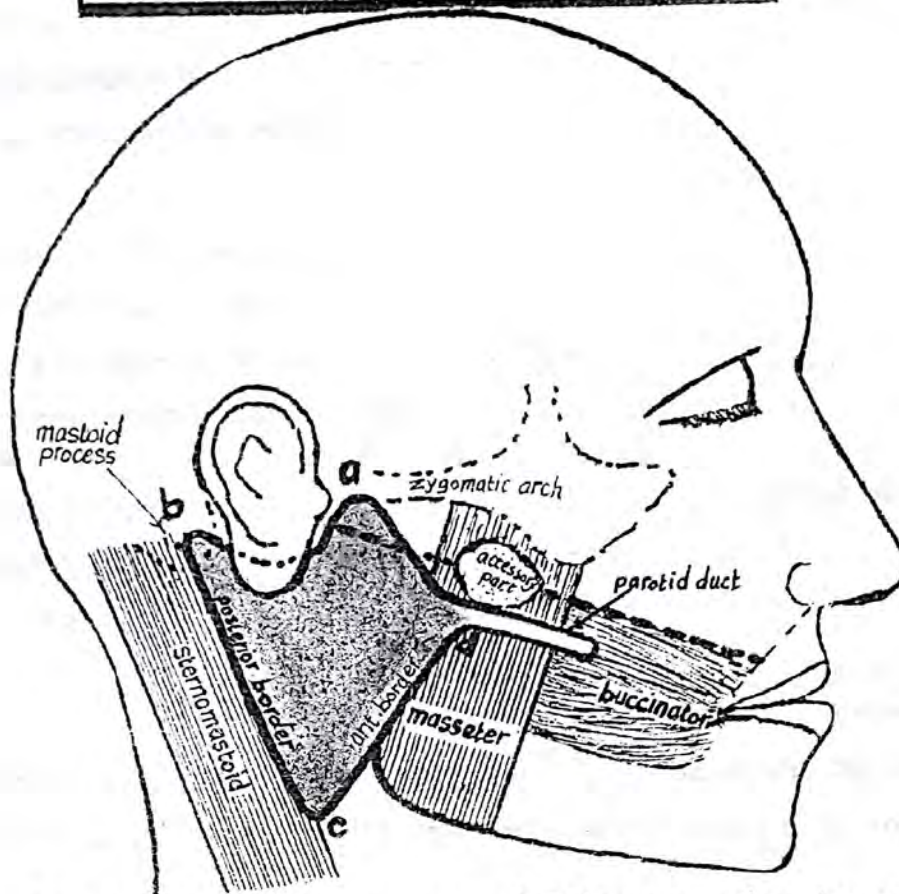
- (1) they are valveless so blood flows in them in both directions.
- (2) they pass through foramina & fissures of the skull.
- (3) Some of them are constant while others may be present or absent.

* **Function:** they serve to equalize the venous blood pressure between the intra cranial venous sinuses & the extra-cranial veins.

* **Most important emissary veins are:**

- (1) Parietal emissary v.: Passes through the parietal emissary f. . It connects the sup. sagittal sinus with the scalp veins (mainly occipital v.)
- (2) mastoid emissary v.: passes through the mastoid emissary foramen . It connects the sigmoid sinus with the occipital or post. auricular vein.
- (3) An emissary v. passes through f. ovale: connects the pterygoid plexus of veins with the Cavernous sinus.
- (4) An emissary v. passes through the post. condylar f. (if present). It connects the sigmoid sinus with the suboccipital plexus of veins.
- (5) An emissary v. passes through the hypoglossal canal. it connects the sigmoid sinus with the internal jugular vein (I.J.V).
- (6) A plexus of vv. pass through Carotid Canal Connecting the Cavernous sinus with I.J.V.
- (7) Emissary v. may pass through f. Coecum Connecting the sup. sagittal sinus with the nasal veins.
- (8) 2-3 small veins pass through f. lacrimum Connecting the I.J.V. with the Cavernous sinus.
- (9) the sup. ophthalmic v. connects the ant. facial v. with the Cavernous sinus. It is considered as the longest emissary vein.

* **Clinical importance:** emissary veins may transmit infection from outside the skull (e.g dangerous area of face) to the dural sinuses.



* **Size** : it is the largest salivary gland. It is serous in nature with few mucous acini.

* **Site & extensions** : it lies below the auricle occupying the deep gap between the ramus of mandible & sternomastoid m. it extends :

- (1) upwards : to the root of the zygomatic arch.
- (2) downwards : to the angle of mandible.
- (3) anteriorly : to cover part of masseter m.
- (4) posteriorly : to overlap sternomastoid m.
- (5) medially : to the pharyngeal wall.

* **Structure (parts)** : it consists of the following parts :

- (1) Main part : is the superficial expanded part between sternomastoid m. & masseter m.
- (2) deep part : is the med. narrow edge of the wedge-shaped gland.
- (3) post-glenoid part : lies in contact with the ext. auditory meatus behind the temporo-mandibular joint.
- (4) accessory part : a small semidetached part lying between the parotid duct & the zygomatic arch.
- (5) Parotid duct (Stensen's duct) : 5 cm. long, it arises from the ant. part of the gland.

* Surface anatomy of parotid gland:

68

- take the following 4 points

- (a) point on the tragus of the ear
- (b) point at the centre of mastoid process
- (c) point 2 cm. below & behind angle of mand
- (d) point at the centre of mandibular notch.

- the gland is mapped out as follows:

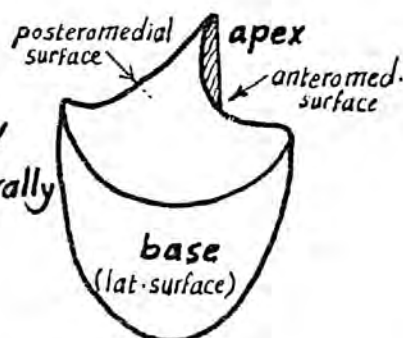
- (1) the upper end (border): extend a curved line around the ext. auditory meatus from the tragus to the centre of mastoid process.
- (2) the posterior border: a straight line along the ant. border of sternomastoid from the centre of mastoid pr. to the point below angle of mandible.
- (3) the anterior border: is represented by 2 lines: a line from the point below the angle of mandible to the centre of mandibular notch & a second line from the last point to the tragus of the ear.

* Surface anatomy of the parotid duct:

it lies opposite the middle $\frac{1}{3}$ of a line extending from the lower border of the tragus of ear to a point midway between angle of mouth & ala of the nose.

* Shape of the gland:

it is wedge-shaped; the apex is directed medially towards the pharynx while the base is directed laterally under the skin.



* Surfaces: it has 3 surfaces:

- (1) lateral (superficial) surface
- (2) anteromedial surface
- (3) posteromed. s

* borders: it has 3 borders:

- (1) ant. border: Convex forwards & gives exit to the parotid duct at the junction of its upper $\frac{1}{3}$ & lower $\frac{2}{3}$
- (2) post. border: straight, & rests on sternomastoid m.
- (3) med. border: Forms the apex of the gland & is directed medially towards the pharynx & the carotid sheath.



* Poles (ends): it has 2 ends:

- (1) upper end (surface): hollowed out to lodge the cartilaginous part of the ext. auditory meatus.
- (2) lower end (pole): is blunt & lies between sternomastoid & angle of mandible.

* Relations of parotid gland:

69

(A) the postero-medial surface:

is irregular & related to:

(1) the mastoid process

& the 2 muscles attached to it: (a) sternomastoid m.

(b) post-belly of digastric m.

(2) the Styloid processes & structures attached to it (mention them).

(3) Carotid Sheath & its Contents:

(a) Int. Carotid a. (I.C.A.)

(b) Int. Jugular V. (I.J.V.)

(c) last 4 cranial nerves (9, 10, 11, 12).

N.B: facial n. pierces this surface & ext. carotid a. grooves it before entering the gland.

(B) the antero-medial surface: is concave & clasps the **3 Ms:**

(1) posterior border of the ramus of Mandible & lat. aspect of the T.M. joint.

(2) Masseter muscle on the outer surface of the ramus of mandible.

(3) Med. pteryoid m. " " inner " " " " " " " " " "

N.B: Maxillary artery emerges from this surface.

(C) the Superficial (lateral) surface: is subcutaneous & related to:

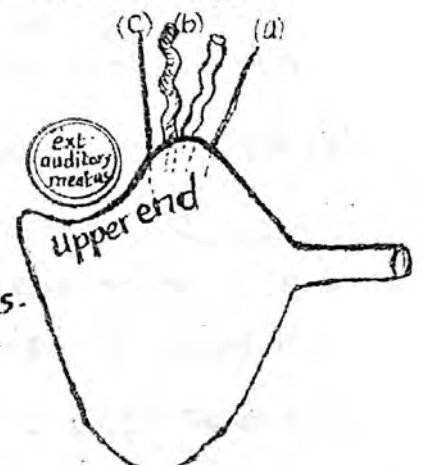
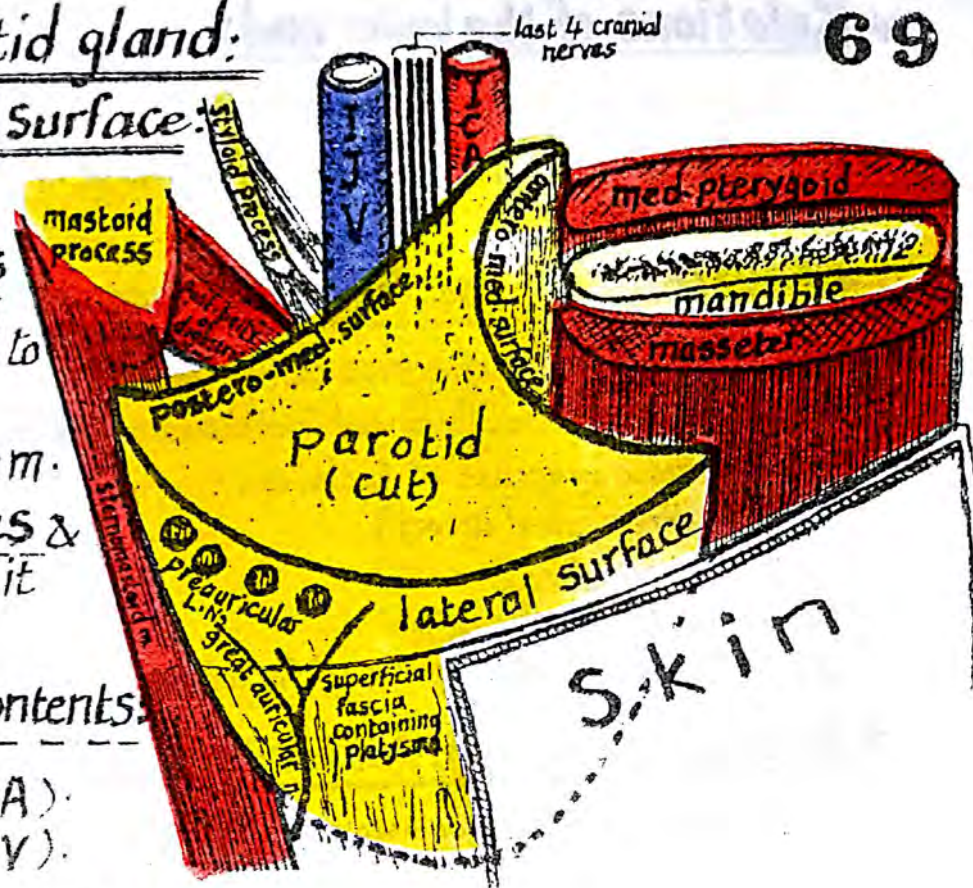
(1) skin & superficial fascia containing platysma, great auricular n. & pre-auricular L.Ns.

(2) parotid fascia & few deep parotid L.Ns embedded in this surface.

(D) Relations of the upper end:

(1) posteriorly: it is related to the cartilagenous part of the external auditory meatus.

(2) anteriorly it gives exit to: (a) temporal br. of facial n.
(b) superficial temporal vessels.
(c) auriculo-temporal n.
(arranged from before backwards)



* Relations of the lower end:

70

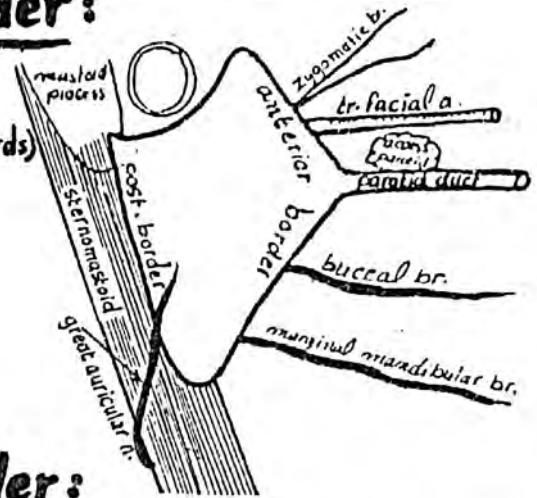
- it lies on post belly of digastric m.
 - the following structures appear under cover of it
- {

- (1) Ext. Carotid a. (ascends)
 - (2) the 2 branches of retromand. v. (descend)
 - (3) the cervical br of facial n.

* Relations of the anterior border:

- it overlaps masseter m & gives exit to the following structures: (arranged from above downwards)

- (1) Zygomatic branches of facial n.
- (2) transverse facial artery.
- (3) **Parotid duct**.
- (4) buccal br. of facial n.
- (5) marginal mandibular br. of facial n.



* Relations of the posterior border:

- it overlaps the Sternomastoid m & is related to:
- {

- (1) great auricular n.
 - (2) mastoid process

* Structures inside the Parotid gland:

- (1) Facial nerve (the most superficial structure):

- it enters the gland through its posteromedial surface.
- it divides inside the gland into 5 terminal branches.

- (2) Retromandibular Vein (intermediate in position):

- it is formed inside the gland by the union of superficial temporal & maxillary vv.
- it descends inside the gland superficial to E.C.A & deep to facial n.
- it divides at the lower end of the gland into ant. & post. branches.

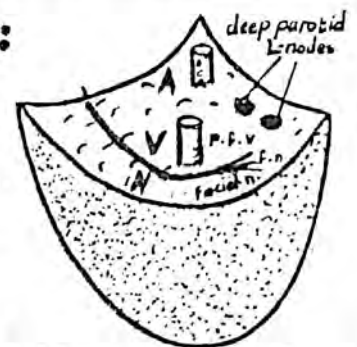
- (3) External Carotid a. (the deepest structure):

- it grooves the posteromed. surface before piercing its lower part to enter the gland.
- it divides inside the gland into 2 terminal branches:
 - (a) Maxillary a. which leaves the gland through the anteromed. surface.
 - (b) Superficial temporal a. which emerges from the upper pole of the gland

- (4) Auriculo-temporal n. (embedded in the upper part of the gland.):

- it enters the upper most part of the anteromed. surface of the gland.
- it supplies sensory & postganglionic parasymp. fibres to the gland.
- it leaves the gland through its upper end.

- (5) Deep parotid Lymph nodes: few L.Ns scattered inside the gland.



* The Parotid duct (Stensen's duct) :

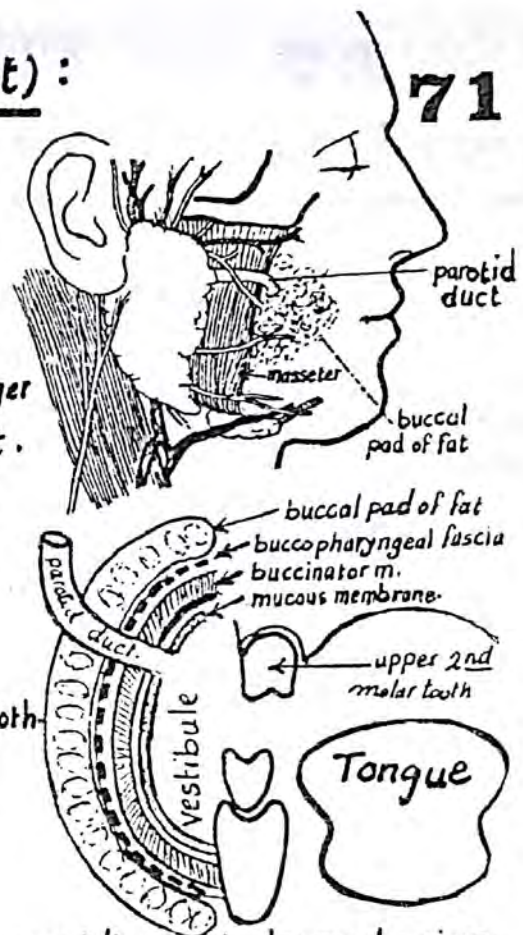
71

- Length : 5 cm. long.
- beginning : at the ant. border of the gland.
- Course & relations :

- (1) it runs horizontally forwards on masseter m. of finger breadth below the zygomatic arch & parallel to it.
- (2) At the ant. border of masseter, it turns sharply medially to pierce the following structures :
 - (a) the buccal pad of fat.
 - (b) the bucco-pharyngeal fascia.
 - (c) the buccinator m. opposite the upper 3rd molar tooth.
 - (d) the buccal mucous membrane lining the cheek.
- (3) it ends by opening into the vestibule of mouth opposite the upper 2nd molar tooth.

N.B : the duct has an oblique course inside buccinator m. providing a valvular mechanism.

- Surface anatomy : see page 68



* Capsule of parotid gland:

the parotid gland has no true fibrous capsule.

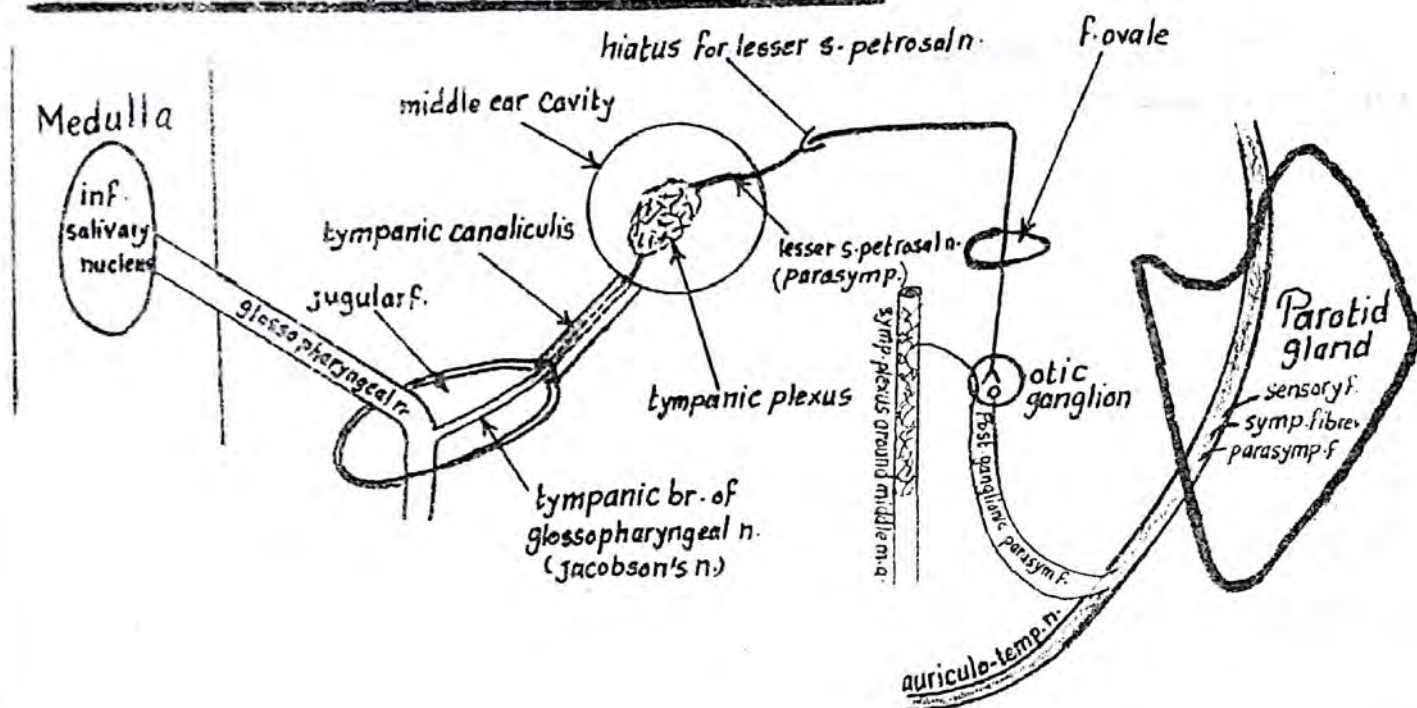
- the gland acquire a fascial capsule derived from the general investing deep fascia of neck which splits at the lower end of the gland into 2 layers :
 - (a) superficial layer : Covering the outer surface of the gland + the masseter m. & is attached above to the zygomatic arch.
 - (b) deep layer : Covering the inner surface of the gland & is attached above to the base of skull. This deep layer forms the stylomandibular lig. which separates the lower pole of parotid from the submandibular salivary gland.

* Blood Supply of parotid gland :

- (A) Arterial supply : small branches from ext. carotid a. inside the gland.
- (B) Venous drainage : into the retro-mandibular vein.

* Lymphatic drainage : into the deep & superficial parotid L.Ns

* Nerve Supply of parotid



- (1) Sensory : (a) the great auricular n. : supplies the Capsule & C.T.
 (b) the auriculo-temporal n. supplies the parenchyma.
- (2) Sympathetic : From the sympathetic plexus around E.C.A & middle meningeal a.
- (3) Parasympathetic (secretomotor) :
 - (a) the preganglionic fibres : arise from the inf. salivary nucleus in medulla & pass with glossopharyngeal n.
 - they leave " " " as the tympanic br. (Jacobson's n.) which passes through the tympanic canaliculus in the jugular f. → middle ear cavity → form the tympanic plexus which gives the lesser superficial petrosal n. → hiatus for lesser s. petrosal → middle cranial fossa → foramen ovale (or innominatum) → infratemporal fossa.
 - (b) the parasymp. fibres Relay in the Otic ganglion
 - (c) the Postganglionic fibres reach the parotid by joining the auriculo-temporal n.

Inside the Cranial Cavity the brain is enveloped by the meninges :
dura mater , arachnoid mater & pia mater (from outside inwards)

- DURA MATER :

- it is the outer layer of the 3 meninges & is formed of strong white fibrous tissue.
- it consists of 2 layers : an outer layer (endosteum)
an inner layer (dura proper)
- These 2 fibrous layers are closely adherent together except in certain areas where :
 - (1) the inner layer separates from the outer layer to form a dural venous sinus.
 - (2) the inner layer is reduplicated to form an inward projecting dural fold.

- DURAL FOLDS :

* definition : they are membranous folds inside the cranial cavity produced by inward reduplication of the inner layer of dura mater between the different parts of the brain.

* Functions :

- (1) they partially subdivide the cranial cavity into compartments thus minimizing the effect of vibrations & shocks on the brain.
- (2) they support the upper parts of the brain thus protecting its lower parts from being pressed on.

* Types of dural folds :

- (A) vertical folds which include :
(B) Horizontal folds " " :
- 1- Falx cerebri.
 - 2- Falx cerebelli.
 - 3- tentorium cerebelli.
 - 4- diaphragma sellae.
 - 5- Cavum trigeminale.

1-FALX CEREBRI

* Shape : it is a sickle shaped fold of dura.

* Site : it descends from the dura of the vault of skull to occupy the median longitudinal fissure between the 2 cerebral hemispheres & above the corpus callosum.

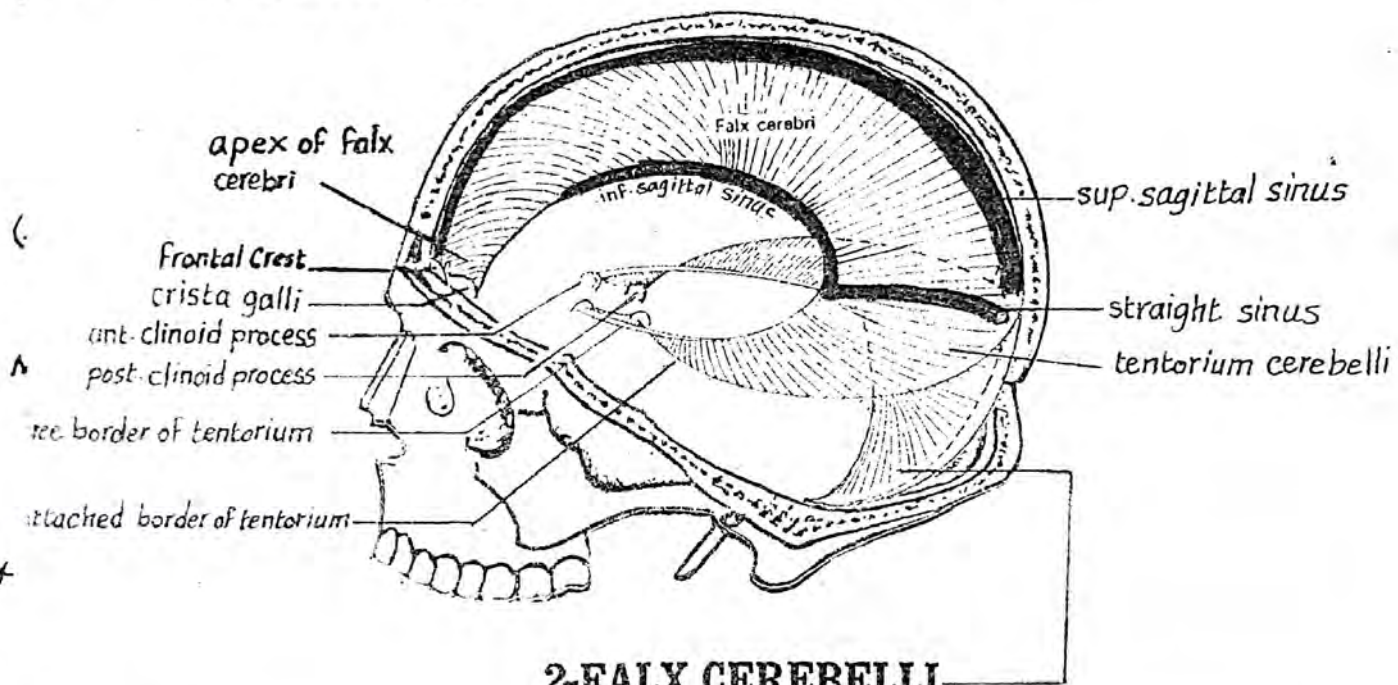
* Parts & attachments:

74

- (1) Apex: is the tapering ant. end. It is attached to the Crista galli & frontal crest
- (2) Base: the post broad end. It is continuous with the upper layer of the tentorium cerebelli.
- (3) upper convex (attached) border: attached to the lips of the Sup. sagittal sulcus.
- (4) lower Concave (free) border: lies above the Corpus Callosum in the bottom of the median longitudinal fissure of brain.

* Venous Sinuses related to the falx Cerebri:

- (1) the Sup. sagittal sinus: runs backwards in the upper attached border of the falx.
- (2) the Inf. Sagittal Sinus: " " in the post. 2/3 of the lower free border.
- (3) the Straight sinus: runs in the base of the falx cerebri.



2-FALX CEREBELLI

* Site: it is a dural fold lying between the Rt. & Lt. Cerebellar hemispheres

* Shape: triangular in shape.

* Parts & attachments:

- (1) base: above & is continuous with the lower layer of tentorium cerebelli.
- (2) apex: below & reaches the post. border of foramen magnum.
- (3) ant. border: projects forwards between the 2 Cerebellar hemispheres.
- (4) Post. border: attached to the internal occipital crest.

* Venous Sinuses related to the falx Cerebelli: the occipital sinus runs in the post. attached border.

3-TENTORIUM CEREBELLI

75

* **Site** : it is a dural fold which roofs the post. Cranial fossa separating the Cerebrum (above) from the cerebellum (below).

* **Shape** : tent-shaped having a peak above.

* **Surfaces** :

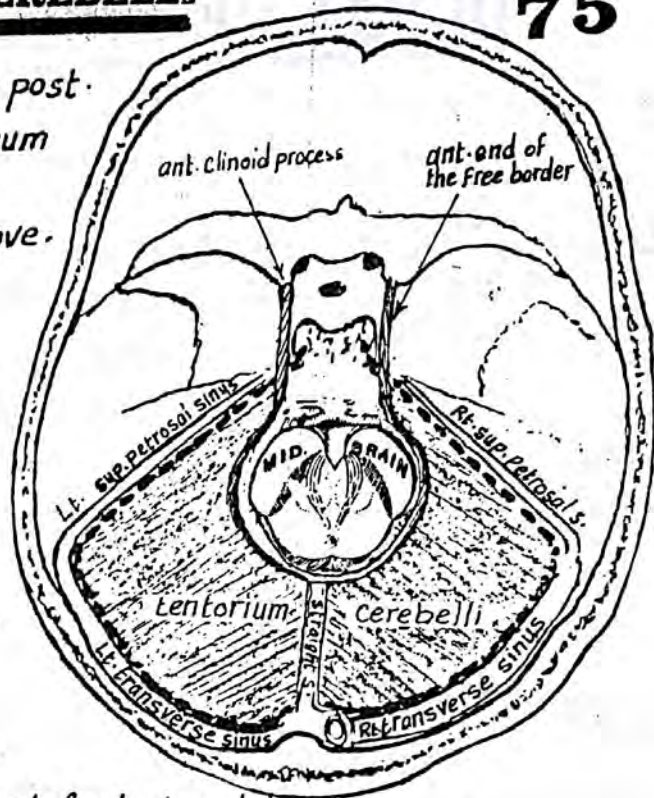
- (1) upper surface : supports the tentorial surface of the brain & gives attachment to the base of the falx Cerebri.
- (2) lower surface : rests on the the upper surface of the cerebellum & gives attachment to the base of falx Cerebelli.

* **Borders** :

- (1) attached (outer) border : attached on either side to the following structures (from before backwards) :
the post. clinoid process, the lips of sup. petrosal sulcus & the lips of transverse sulcus
 - (2) free (inner) border : is U-shaped surrounding midbrain (in the tentorial notch).
The ant. end of the free border crosses over the ant. end of the attached border to be attached to the ant. Clinoid process.
- N.B : 3 Cranial nerves pierce the dura in relation to the point of crossing of the 2 borders:
- (a) Oculomotor n. : " " " in front of the point of crossing.
 - (b) trochlear n. : " " " at the point of crossing.
 - (c) trigeminal n. : " " " behind the point of crossing.

* **Dural Venous sinuses related to the tentorium** :

- (1) the Rt. & Lt. sup. petrosal sinuses
 - (2) the Rt & Lt. transverse sinuses
- } run in the attached outer border
- (3) the Straight sinus runs on the upper surface along the line of attachment of the falx cerebri.



4-CAVUM TRIGEMINALE

it is a sacculated fold of the inner layer of dura mater in the middle Cranial fossa near the apex of the petrous temporal bone. It covers the trigeminal ganglion.

5-DIAPHRAGMA SELLAE

it is a small circular fold of the inner layer of dura that roofs the sella turcica above the pituitary gland. It has a central hole for the infundibulum. It stretches between the 4 clinoid processes. The ant. & post. intercavernous sinuses run in the ant. & post. borders of this fold.

DURAL VENOUS SINUSES

76

* **Definition**: they are venous channels inside the cranial cavity between the inner & outer layers of the dura mater.

* **Characters**: (1) they may be single, paired or may form multiple channels.
 (2) they are lined by endothelium.
 (3) they are devoid of valves.
 (4) many of them groove the bones on which they lie.

* **Tributaries**: their tributaries mostly come from (1) the brain (2) the meninges (3) orbit (4) internal ear. They also drain the cerebro spinal fluid from the subarachnoid space. Many of them communicate with the extra cranial veins via emissary veins.

* **Drainage**: all sinuses drain ultimately into the internal jugular vein.

* **Classification**:

single sinuses	Paired sinuses
(1) Sup. Sagittal sinus.	(1) sphenoparietal sinuses.
(2) inf. sagittal sinus.	(2) Cavernous sinuses.
(3) straight sinus.	(3) sup. petrosal sinuses.
(4) occipital sinus.	(4) inf. petrosal sinuses.
(5) basilar sinus.	(5) transverse sinuses.
	(6) sigmoid sinuses.
	(7) intercavernous sinuses

(1) SUP. SAGITTAL SINUS

* **Beginning**: it begins at the apex of falx cerebri above the crista galli.

* **Course**: it passes backwards along the upper convex border of the falx cerebri grooving the inner aspect of the skull cap (forming the sup. sagittal sulcus).

* **Size**: it is the largest venous sinus. Its size increases as it passes backwards.

* **Termination**: it ends a little to the Rt. of the internal occipital protuberance by turning to the Rt. side & becoming the Rt. transverse sinus.

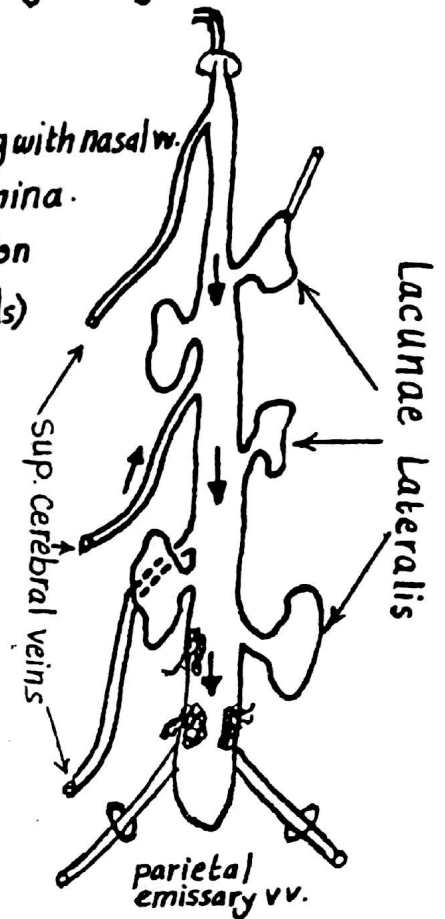
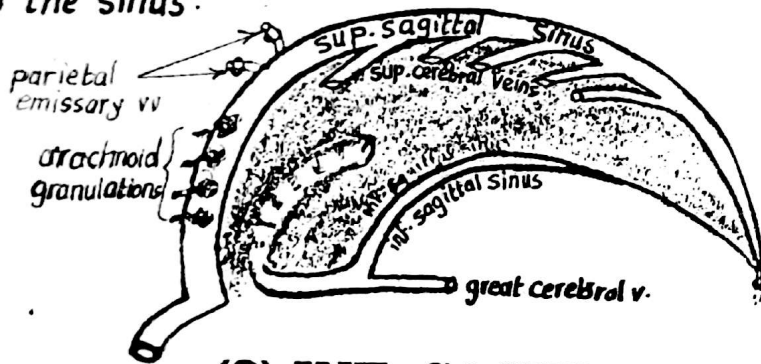
* **Variations**: (1) it may turn to the Lt. side to become continuous with the Lt. transverse sinus.

(2) it may open into a dilatation called confluence of sinuses (at the int. occipital protuberance) from which arise Rt. & Lt. transverse sinuses.

* Surface anatomy: represented by a broad line extending from glabella toinion.

* Tributaries:

- (1) one emissary v. may pass through f. Coecum Communicating with nasal v.
- (2) 2 emissary veins passing through parietal emissary foramina.
- (3) Sup. Cerebral veins (opening in the sinus against the direction of flow of blood (i.e from before backwards))
- (4) meningeal veins } open into cleft-like outpocketings from
- (5) diploic veins } the sinus called the "lacunae lateralis"
- (6) arachnoid granulations which filter the C.S.F into the venous blood. They are more numerous at the post. part of the sinus.



(2) INF. SAGITTAL SINUS

* Site: it lies in the post 2/3 of the lower free border of the falx Cerebri

* termination: it ends at the free margin of the tentorium by uniting with the great Cerebral vein to form the Straight sinus.

* Tributaries: it drains the falx Cerebri & receives some of the infero-medial veins of the 2 Cerebral hemispheres.

(3) STRAIGHT SINUS

* Beginning: it is formed by the union of the inf. sagittal sinus & the great Cerebral v.

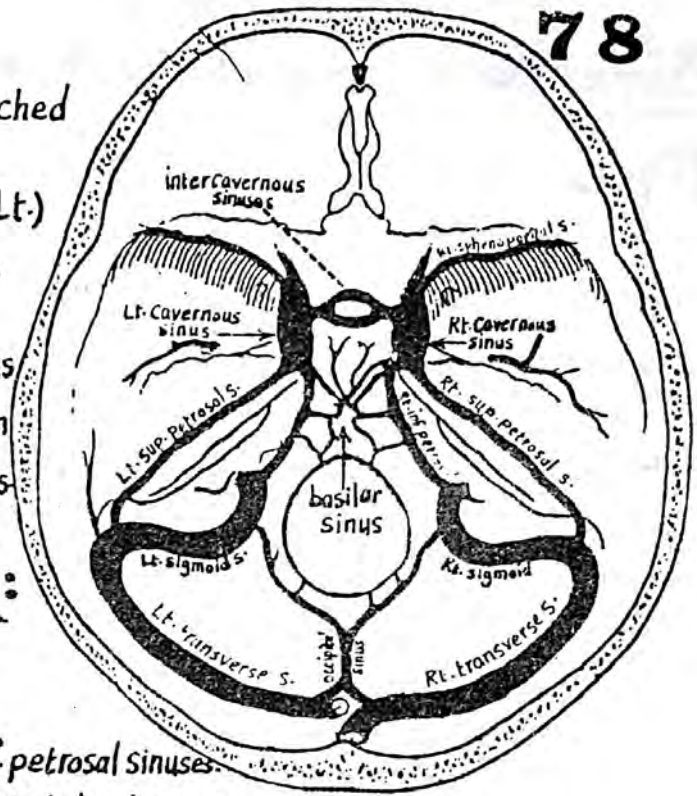
* Course: it runs backwards along the the line of attachment of the falx Cerebri to the tentorium.

* termination: at the int. occipital protuberance, it usually turns to the Lt. forming the Lt. transverse sinus. It may open in the Confluence of sinuses

* An epithelio-sinusoidal body lying in the ant. part of the sinus controls the flow of venous blood from the great cerebral v. thus regulating the formation of the C.S.F.

(4) OCCIPITAL SINUS :

- it is a small sinus which runs in the attached border of the Falx cerebelli
- it is formed posteriorly by 2 veins (Rt. & Lt.) arising from the beginning of the Rt. & Lt. transverse sinuses.
- it ends anteriorly by dividing into 2 veins passing along the margins of the foramen magnum to join the ends of sigmoid sinuses



(5) BASILAR PLEXUS OF SINUSES:

- it is formed of plexus of venous channels lying on the clivus of the skull.
- it communicates on each side with the inf. petrosal sinuses.
- it communicates below with the internal vertebral venous plexus.

(6) SPHENOPARIETAL SINUSES :

- each one runs along the free border of the lesser wing of sphenoid.
- each sinus receives small dural veins + the ant. branch of the middle meningeal v.
- " " ends by joining the anterolateral aspect of the Cavernous sinus.

(7) CAVERNOUS SINUS

- it is one of the most important dural venous sinuses.
- it derives its name from the fact that its cavity contains a network of interlacing trabeculae (caverns) giving it a spongy appearance.

Site : it lies on the side of the body of sphenoid in the middle Cranial fossa.

It extends from the sup. orbital fissure anteriorly to the apex of petrous temporal bone posteriorly.

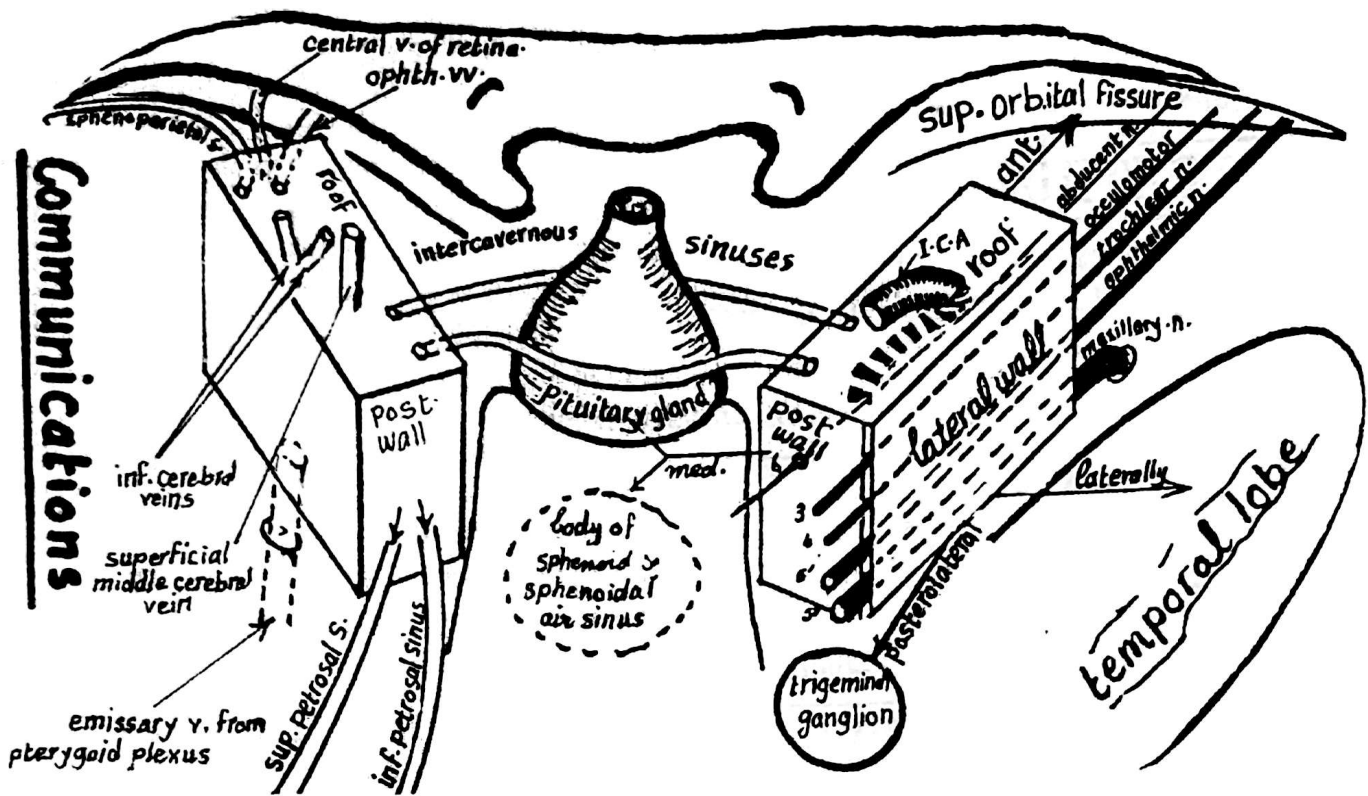
* **Size :** it is about 2cm. long x 1cm wide.

* **Relations :**

- (1) anteriorly : sup. orbital fissure
- (2) posteriorly : apex of petrous temporal bone & trigeminal ganglion (posterolaterally).
- (3) Medially : pituitary gland, body of sphenoid & sphenoidal air sinus.
- (4) Laterally : uncus of temporal lobe of brain.

(5) Superiorly : I.C.A as it passes backwards after leaving the sinus. **79**

(6) Inferiorly : body of sphenoid & sphenoidal air sinus.



* Structures inside the sinus :

(1) I.C.A. : runs forwards through the sinus. Its pulsations help the drainage of the sinus.

(2) Abducent n. : runs forwards inferolateral to the I.C.A.

N.B : Some authors regard these structures as passing in the med. wall of the sinus.

* Structures embedded in the lat. wall of the sinus :

- | | |
|-----------------------|----------------------------------|
| (1) oculomotor n. (3) | } arranged from above downwards. |
| (2) trochlear n. (4) | |
| (3) ophthalmic n. (5) | |
| (4) maxillary n. (5) | |

* Tributaries & Communications of the sinus :

- (1) ophthalmic vv., sphenoparietal sinus & central v. of retina : open in its ant. end.
- (2) Superficial middle cerebral v. & some inf. cerebral veins : open in its upper surface.
- (3) emissary vv. from the pterygoid plexus (of. ovale & lacerum) : open in the lower surface.
- (4) Inter-cavernous sinuses & vv. from pituitary gland : open in the medial surface.

Relations

inc
ch

at the supraorbital notch to open into the supraorbital vein.

81

- (2) temporal diploic veins : they are 2 veins (ant. & post.). The ant. vein descends in the frontal bone to open into the sphenoparietal sinus, while the post. vein descends in the parietal bone to open into the transverse sinus.
- (3) occipital diploic vein : it is the largest diploic v. It descends in the occipital bone parallel to the middle line to open into the beginning of the transverse sinus.

PITUITARY GLAND

* Site : it lies in the hypophyseal fossa below the diaphragma sellae.

* Shape : it is an ovoid body, its transverse diameter is 12 mm. & its anteroposterior diameter is 8 mm.

* Relations :

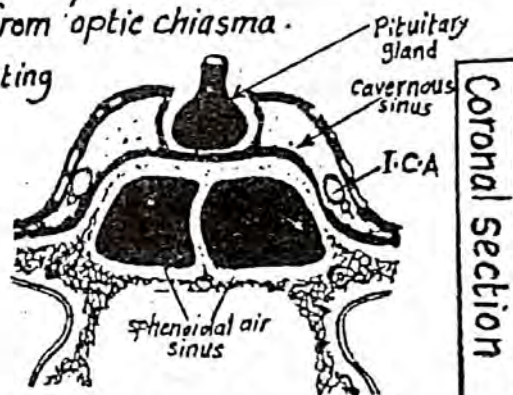
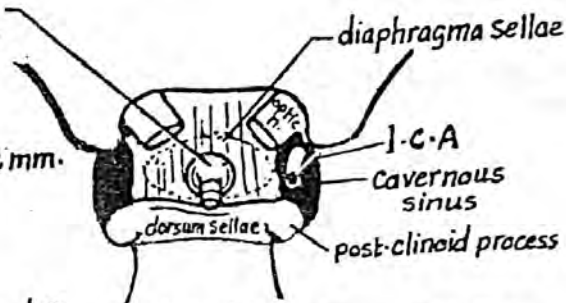
- (1) above : diaphragma sellae which separates the gland from optic chiasma.
- (2) below : body of sphenoid & sphenoidal air sinus separating the gland from nasopharynx.
- (3) anteriorly : tuberculum sellae & sphenoidal air sinus.
- (4) posteriorly : dorsum sellae separating the gland from pons & basilar a.
- (5) On each side : Cavernous sinus & its contents.

* Connections of the gland :

it is connected to the tuber cinereum of the hypothalamus by a hollow conical stalk called the infundibulum.

* Arterial Supply : sup. & inf. hypophyseal arteries from the I.C.A on each side.

* Venous drainage : into the surrounding dural venous sinuses : Cavernous & intercavernous.



NERVE SUPPLY OF DURA MATER

(A) Supratentorial dura : supplied by trigeminal n. as follows :

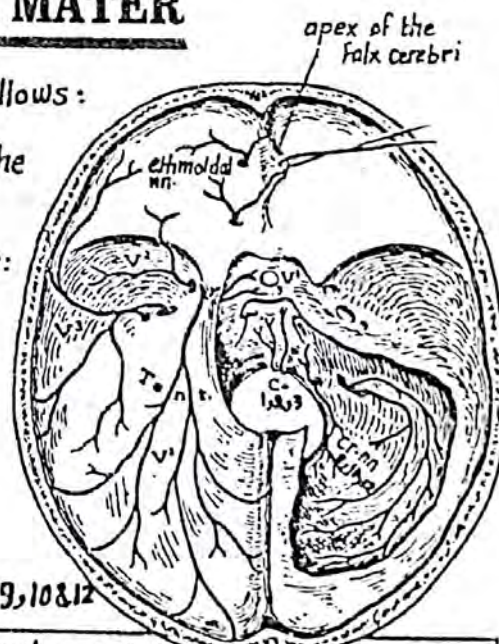
- (1) the dura mater of the ant. cranial fossa : supplied by the ethmoidal branches of ophthalmic n.
- (2) the dura mater of the middle cranial fossa is supplied by :
 - (a) meningeal br. of maxillary n. (middle meningeal n.)
 - (b) meningeal br. of mandibular n. (nervus spinosus)
- (3) the tentorium cerebelli & the falx cerebri : is supplied by the meningeal branches of ophthalmic n.

(B) Infra tentorial dura (post. cranial fossa) :

supplied by the meningeal branches of the cranial nn. 9, 10 & 12

(C) Dura mater around the f. magnum :

supplied by the upper 3 cervical nerves



V¹ = ophthalmic n. Cr. = cranial
V² = maxillary n. C = cervical
V³ = mandibular n.

(A) Meningeal arteries of ant. cranial fossa :

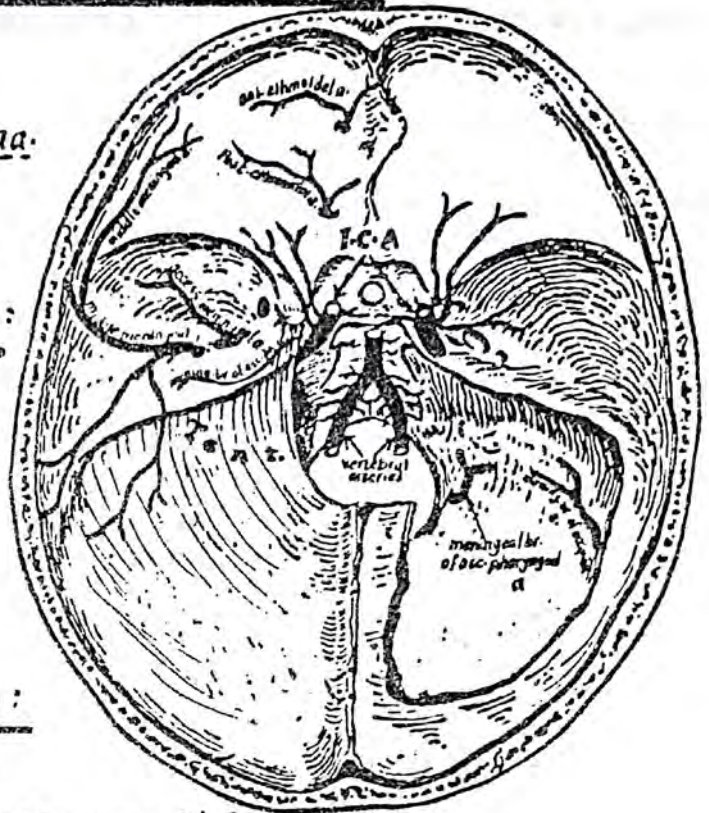
- (1) meningeal branches of ant. & post. ethmoidal aa.
- (2) " " of int. carotid a.
- (3) some branches of middle meningeal a.

(B) Meningeal arteries of middle cranial fossa :

- (1) meningeal branches of I.C.A.
- (2) middle meningeal a. (br. of maxillary a.)
- (3) accessory " " (" " " ")
- (4) meningeal br. of ascending pharyngeal a.
(passing through f. lacerum)

(C) Meningeal arteries of post. cranial fossa :

- (1) meningeal branches of vertebral arteries
- (2) meningeal br. of occipital a. passing through the mastoid f.
- (3) meningeal br. of ascending pharyngeal a. passing through hypoglossal canal.



VENOUS DRAINAGE OF DURA MATER

- * The venous blood of the dura is drained by :
- (1) the dural venous sinuses.
 - (2) " emissary veins.
 - (3) " meningeal veins.

* Meningeal veins :

- they lie in grooves on the inner surface of the vault of the skull.
- the most important of them are the middle meningeal veins.

Middle meningeal Veins

- they begin from the dural venous plexus outside the dura.
- they run in grooves on the inner aspect of the parietal bone accompanying the branches of the middle meningeal artery.
- these veins differentiate into 2 trunks; ant. & post. which end as follows:

- A- the ant. trunk : may
- join the sphenoparietal sinus.
 - join the cavernous sinus.
 - passes through f. ovale to end in the pterygoid plexus.
- B- the post. trunk : passes through f. spinosum to join the pterygoid plexus of veins.

*Bony Orbit:

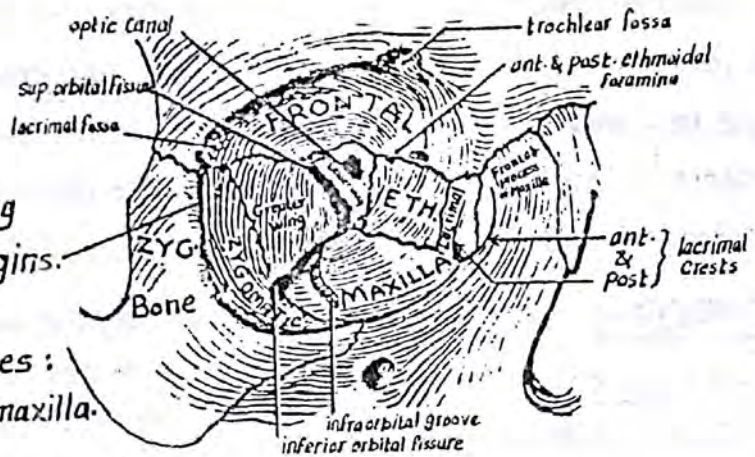
- it is a pyramidal shaped space in the norma frontalis having base, apex & 4 walls.
- its base is the orbital opening having upper, lower, medial & lateral margins.
- its apex lies at the optic canal.
- its med. wall is formed by 3 bones:

- (a) frontal process of maxilla.
- (b) lacrimal bone.
- (c) orbital plate of ethmoid.

- its lat. wall is formed by 2 bones: (a) frontal process of zygomatic bone.
- (b) greater wing of sphenoid.

- its Roof is formed of: (a) orbital plate of frontal bone.
- (b) lesser wing of sphenoid (in the most post. part).

- its Floor: " " " (a) orbital surface of maxilla (b) maxillary process of zygomatic bone.



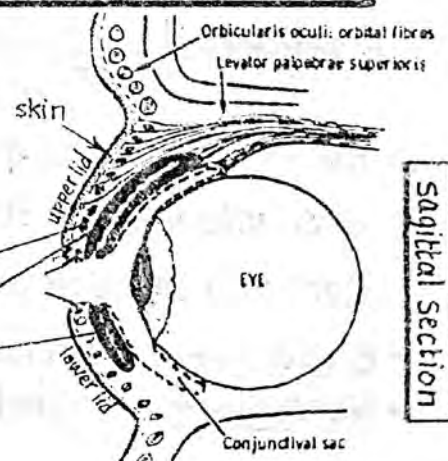
*Foramina & fissures of the orbit:

Foramen	Position	Structures Passing
Optic f.	at the apex of the orbit, in the lesser wing of sphenoid.	(1) optic n. (surrounded by its meninges). (2) Ophthalmic artery.
Sup. orbital fissure	between the roof & the lat. wall of the orbit.	(1) oculomotor n. (2) trochlear n. (3) opth. n. (4) abducent n. (4) ophthalmic veins.
Inf. orbital fissure	between the lat. wall & the floor of the orbit.	(1) infraorbital n. (2) infraorbital a. (3) Zygomatic n. (4) orbital br. of sphenopalatine ganglion (5) emissary v. between inf. orbital v. & pterygoid plexus.
ant. ethmoidal f.	on the med. wall of the orbit.	ant. ethmoidal nerve & vessels.
Post. ethmoidal f.	" " " " " " "	Post. ethmoidal nerve & vessels.
infra-orbital groove & canal	" " Floor of the orbit.	infra-orbital nerve & vessels.

THE EYE LIDS

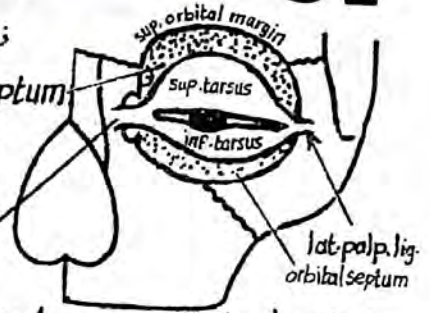
*Structure:

- (1) Skin: thin, loose & easily distensible by cedem or blood.
- (2) Superficial fascia: devoid of fat & contains the palpebral part of orbicularis oculi muscle.
- (3) Tarsus: a thin plate of dense fibrous tissue which has the following characters:



Sagittal section

- (a) the tarsal plate of each lid is broad at its middle & narrow at its ends.
 (b) each tarsus has : (1) free or ciliary border towards the eye lashes;
 (2) attached border connected to the orbital margin by the orbital septum.
 (c) the lat. ends of both tarsi are attached to the lat. orbital margin by the lat. palpebral lig. while the med. ends of both tarsi are connected to the med. orbital margin by the med. palpebral lig.
 (d) tarsal glands are embedded in the post. surface of the tarsi & their ducts open behind eye lashes
- (4) Conjunctiva** : a mucous memb. lining the post. surfaces of the 2 eye lids (p. 85).
- * **The free edge of each eye lid shows** :
 eyelashes : arranged in 2 or 3 rows
 lacrimal punctum on the med. end of each margin (p. 85).
 - * **The fissure between the 2 lids is called palpeb. fissure.**
 - * **Arteries of the eye lids** :
 (1) med. palpebral arteries : from ophthalmic a.
 (2) lat. palpebral arteries : from lacrimal a.
 - * **Nerves of the eye lids** :
 upper eye lid : supplied by ophthalmic n.
 lower " " : " " maxillary n.
 - * **Lymphatics of the 2 eye lids** : drain into the submandibular & parotid L.Ns.

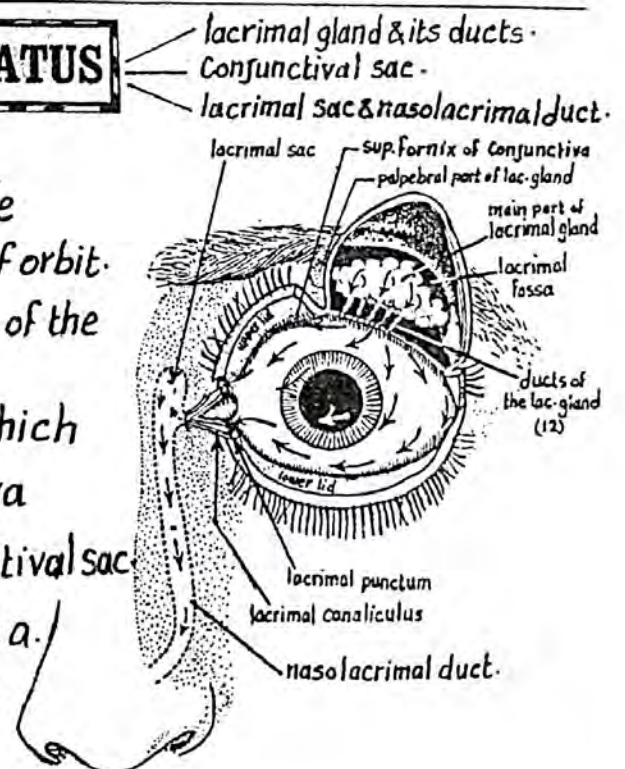


CONTENTS OF THE ORBIT

- (1) The eye ball (see histology). (2) the lacrimal apparatus.
 (3) 7 extraocular muscles.
 (4) Nerves of the orbit :
 (a) special sensory n. : the optic nerve
 (b) general sensory n. : the ophthalmic n.
 (c) motor nerves : oculomotor, trochlear & abducent nn.
 (d) autonomic » : sympathetic, parasymp. & ciliary ganglion
 (5) Vessels : (a) ophthalmic a. (b) sup. & inf. ophthalmic veins
 (6) Orbital ligaments, fascia & fat.

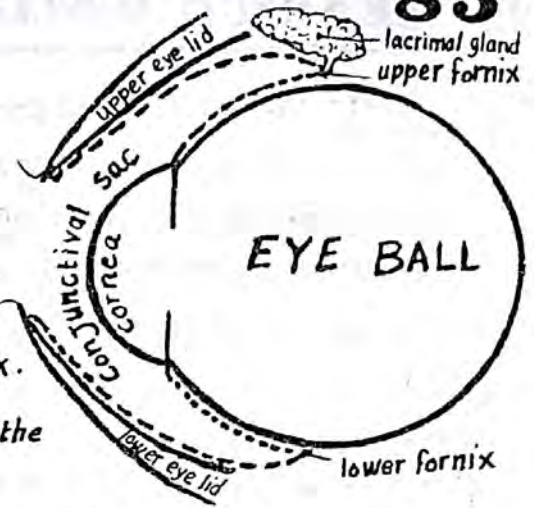
LACRIMAL APPARATUS

- (1) The lacrimal gland : has 2 parts :
 (a) Main part : lies in the lacrimal fossa in the anterolateral part of the roof of orbit.
 (b) palpebral part : embedded in the lat. part of the upper eye lid.
 - the lacrimal gland gives about 12 ducts which open into the sup. fornix of conjunctiva carrying the secreted tears to the conjunctival sac.
- * **Blood supply** : lacrimal branch of ophthalmic a.
 - * **Nerve supply** : lacrimal br. of ophthalmic nerve.



(2) Conjunctival sac :

- The Conjunctiva is a membrane which lines the eye lids & is reflected to cover the ant. part of the eye ball (except the Cornea).
- the lines of reflection of the Conjunctiva from the upper & lower lid onto the eye ball are called sup. fornix & inf. fornix.
- when the eye lids are closed, the space between them & the eye ball is called the Conjunctival sac.
- most of the tears reaching the conjunctival sac evaporates, the remaining amount pass to the lacrimal puncti.



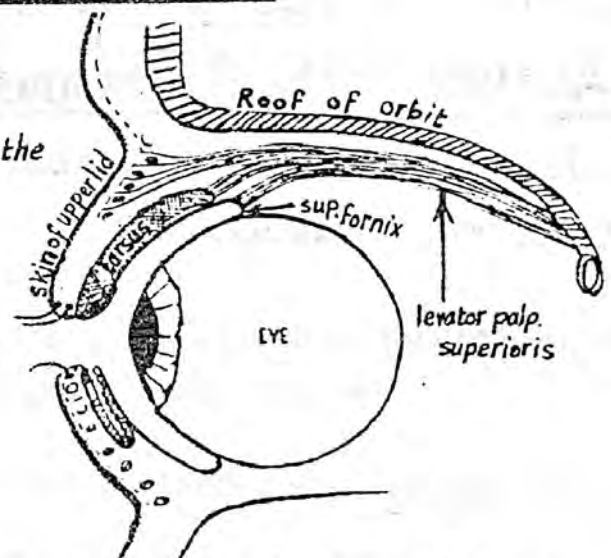
(3) Lacrimal puncti, Canaliculi & lacrimal sac :

- the lacrimal puncti are 2 minute openings present in the med. ends of the margins of the upper & lower eye lids.
- these puncti lead to 2 Canaliculi opening in the lacrimal sac.
- the lacrimal sac lies in the lacrimal groove between the ant. & post. lacrimal crests.
- Nasolacrimal duct arises from the sac & passes through the nasolacrimal Canal to open in the inf. meatus of the nose.

EXTRAOCULAR MUSCLES

(A) LEVATOR PALPEBRAE SUPERIORIS

- Origin : from the post. part of the roof of orbit just in front of the optic foramen.
- Insertion : the muscle passes forwards below the roof & above the sup. rectus m. & divides into 3 slips inserted into :
 - (1) the skin of the upper eye lid.
 - (2) the tarsus
 - (3) the upper fornix of Conjunctiva.
- Nerve supply :
 - (1) Sup. division of oculomotor n.
 - (2) Symp. fibres (from sup. cervical symp. ganglion) supply the deep part of the m. which is involuntary & called Muller's muscle.
- Action : elevates the upper eye lid & upper fornix of conjunctiva.

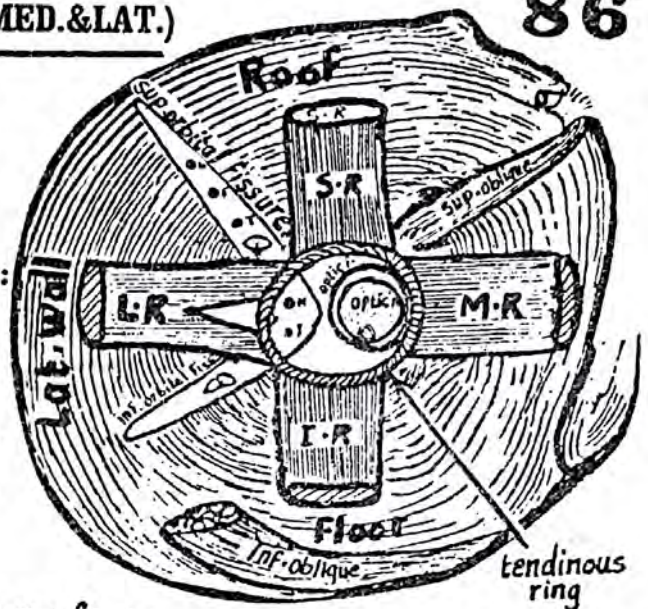


(B) THE 4 RECTI MUSCLES (SUP., INF., MED. & LAT.)

86

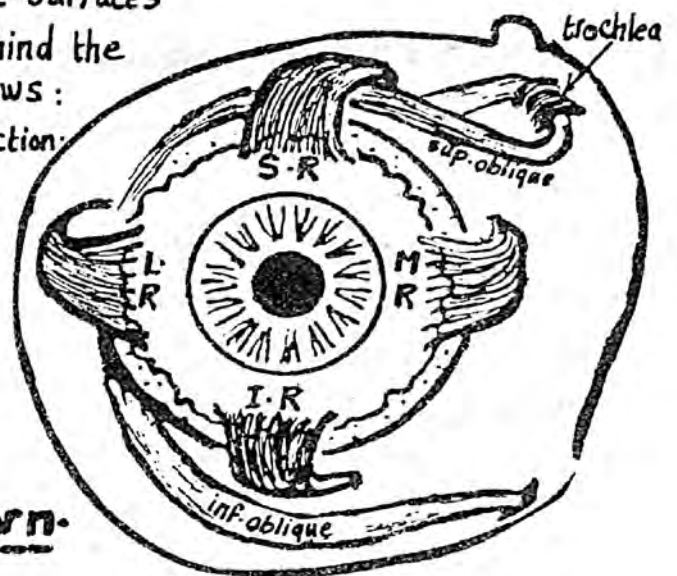
*** Origin:** they arise from the tendinous ring which is a fibrous tissue ring situated at the apex of the orbit surrounding the optic f. & the med. ends of the sup. & inf. orbital fissures:

- (1) sup. rectus : arises from sup. part of the ring.
- (2) inf. " : " " inf " " " "
- (3) med. " : " " med. " " " "
- (4) lat. rectus : arises by 2 heads from the lat. part of the tendinous ring.



*** Insertion:** into the sup, inf., med. & lat. surfaces of the sclera, short distance behind the Corneo-scleral junction as follows :

- (1) sup. rectus : 7.5 mm. behind corneoscleral junction.
- (2) inf. rectus : 6.5 mm. " " " "
- (3) med. rectus : 5.5 mm. " " " "
- (4) lat. rectus : 7 mm. " " " "

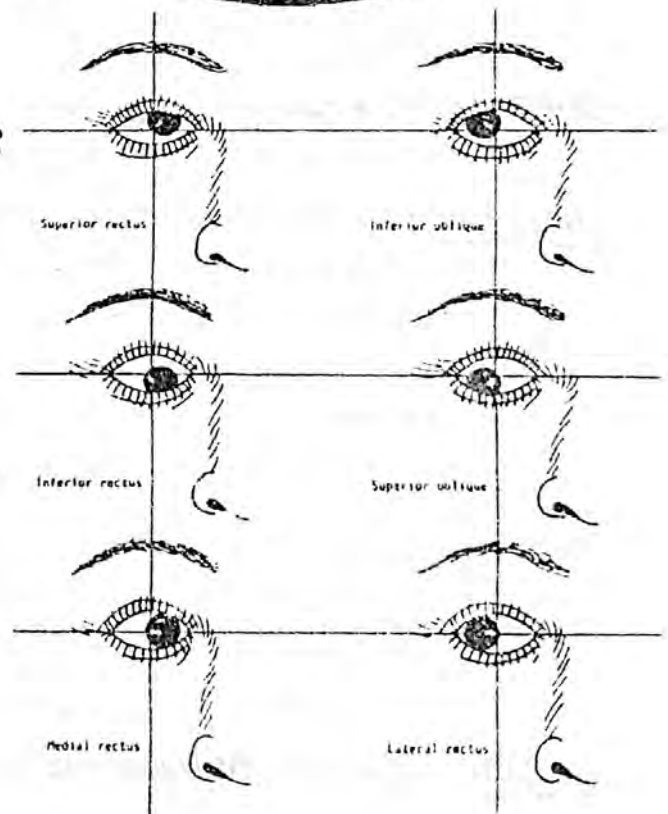


*** Nerve Supply :**

- (1) sup. rectus : by sup. division
 - (2) inf. rectus : by inf. division
 - (3) med. rectus : by inf. division
 - (4) lat. rectus : by Abducent (6) n.
- } of Oculomotor n.

*** Action of the Recti muscles:**

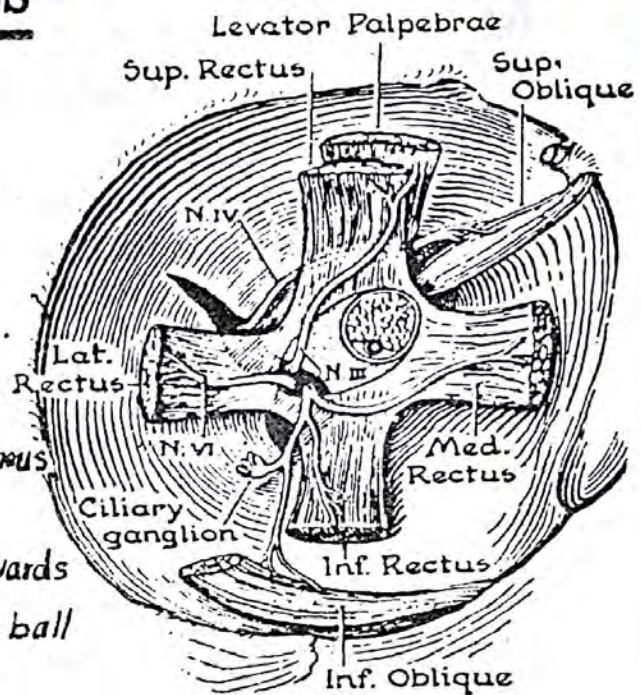
- (1) lat. rectus : abducts the eye ball.
- (2) med. rectus : adducts " " "
- (3) Sup. rectus : elevates, adducts & rotates the eye medially.
- (4) Inf. rectus : depresses, adducts & rotates the eye medially.



(C) THE OBLIQUE MUSCLES

(1) Sup. oblique:

- * Origin: from the post. part of the roof of orbit anteromedial to the optic foramen.
- * Insertion: - it passes forwards above the med. rectus.
 - at the antero-med. angle of the orbit it forms a tendon which passes through a fibro-cartilagenous pulley (trochlea).
 - then it curves backwards laterally & downwards to be inserted into the lat. aspect of the eye ball between sup. rectus & lat. rectus.



- * Nerve Supply: trochlear n. (4) ... [remember S.O. 4]
- * Action: it depresses, abducts & rotates the eye laterally [look to your shoulder!].

(2) Inf. Oblique:

- * Origin: from the floor of orbit lat. to the lacrimal groove.
- * Insertion: the muscle passes laterally, upwards & backwards below inf. rectus to be inserted into the lat. aspect of the sclera (Close to the insertion of sup. oblique).
- * N. supply: inf. division of oculomotor n.
- * Action: it elevates, abducts & rotates the eye laterally.

Summary of the nerve supply of the extra ocular muscles

all extra-ocular muscles are supplied by OCCULOMOTOR (3)n. Except:

- (1) Lat. Rectus (L.R): supplied by the abducent (6)n ... [remember LR 6]
- (2) Sup. Oblique (S.O) " " " trochlear (4)n ... [remember S04]

OPTIC NERVE

88

* **Type** : special sensory n. Carrying visual impulses.

* **Origin** : its fibres are the axons of the ganglion cells of the retina.

* **Exit From eye ball** : it pierces the sclera 3-4 mm. med. to the post. pole of the eyeball.

* **Course & relations** :

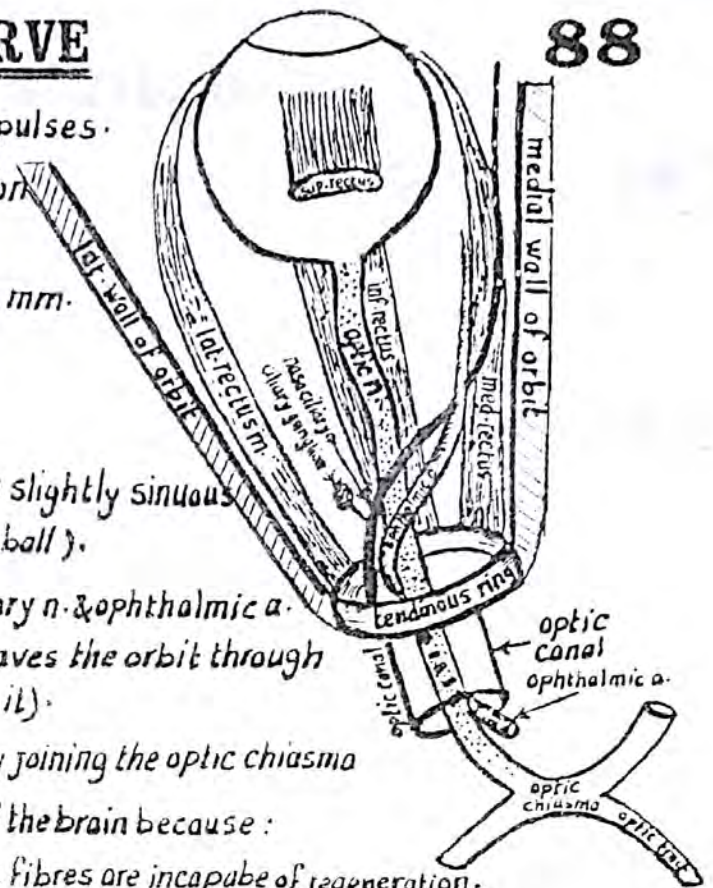
- (1) it turns backwards & medially following a slightly sinuous course (to allow free movements of the eye ball).
- (2) it is crossed from lat. to med. by the naso ciliary n. & ophthalmic a.
- (3) it passes inside the tendinous ring then leaves the orbit through the optic canal (with the ophthalmic a. below it).

* **Termination** : it ends in the cranial cavity by joining the optic chiasma

* **N.B** : (1) the optic n. is considered as a tract of the brain because :

- (a) it has no neurilemmal sheath so its fibres are incapable of regeneration.
- (b) it is surrounded by meninges (pia, arachnoid & dura).

(2) Optic n. is pierced by the central a. of retina (br of ophthalmic a.) about 12 mm behind the eye ball.



OPHTHALMIC NERVE

Type : general sensory n.

* **Origin** : arises as the 1st branch of trigeminal ganglion.

* **Course & relations** :

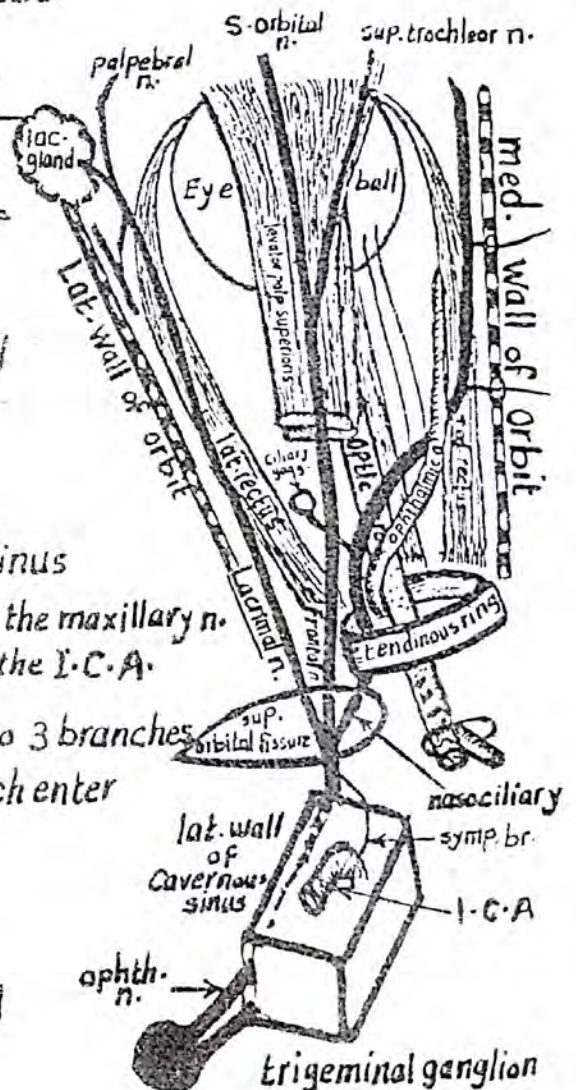
- (1) it runs forwards in the lat. wall of Cavernous sinus below the oculomotor & trochlear nn. & above the maxillary n.

N.B : it receives a symp. br. from the plexus around the I.C.A.

- (2) it leaves the cavernous sinus then divides into 3 branches lacrimal, frontal & nasociliary all of which enter the orbit through the sup. orbital fissure.

* **Branches** : 1- **Meningeal br.**

sensory to the Supratentorial dura & falx Cerebri.



2-LACRIMAL NERVE

- it is the smallest br. of the ophthalmic n.
- it enters the orbit through the sup. orbital fissure (outside the tendinous ring).
- it runs forwards along the lat. wall of the orbit above the lat. rectus & accompanied by lac. a.
- it receives a communicating br. from the zygomatic n., through which secretomotor parasymp. fibres are conveyed to the lacrimal gland.
- it supplies : (1) the lacrimal gland by sensory & parasymp. secretomotor fibres.
(2) u skin of the lat. part of the upper eye lid by a palpebral branch.

3-FRONTAL NERVE

- It is the largest br. of the ophthalmic n.
- it enters the orbit through the sup. orbital fissure (outside the tendinous ring).
- it runs forwards beneath the orbital periosteum & above the levator palpebrae sup.
- it ends about the middle of the orbit by dividing into 2 terminal branches :

(1) Supra-trochlear n. :

- is the smaller br. & runs forwards & medially above the trochlea of sup. oblique m.
- it comes out of the orbit about one finger from the middle line.
- it supplies the med. part of the upper eye lid & the overlying skin of forehead.

(2) Supra-orbital n. :

- it is the larger br. & runs forwards to leave the orbit through the supra orbital notch or foramen 2 fingers from the middle line.
- it supplies the middle part of the upper eye lid then divides into a small med. br. & a large lat. br. supplying the forehead & scalp as far behind as the lambdoid suture.

4-NASO-CILIARY NERVE

- it is intermediate in size between the lacrimal & frontal nerves.
- it enters the orbit through the sup. orbital fissure inside the tendinous ring.
- it runs obliquely (with ophthalmic a.) forwards & medially crossing above Optic n.
- It passes along the med. wall of the orbit between the sup. oblique & med. rectus.
- it ends by dividing into ant. ethmoidal & infra trochlear nerves.
- Branches :
(a) sensory root : to the ciliary ganglion.

(2) 2 long ciliary nerves : pierce the sclera med to the optic n. Carrying sensory & also symp. fibres (from the int. Carotid symp. plexus) to the dilator pupillae m.

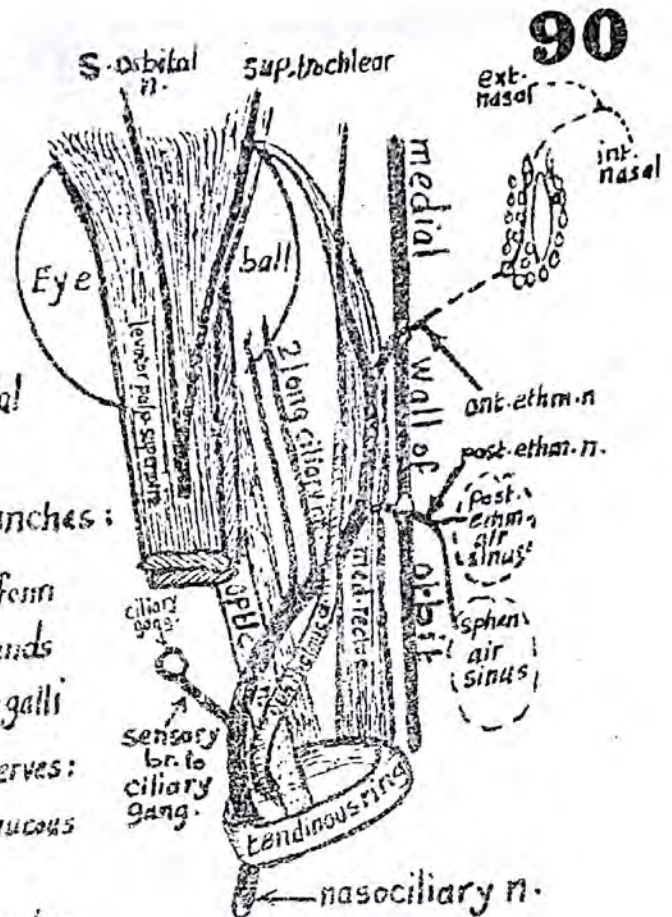
(3) post-ethmoidal n. : enters the post-ethm. f. to supply the m-membrane of the sphenoidal & post-ethmoidal air sinuses.

(4) ant-ethmoidal n. : one of the 2 terminal branches :

- it enters the ant. ethm. f. → side of cribriform plate of ethmoid → runs forwards then descends to the nasal cavity through a slit close to crista galli
- it ends in the nose by giving int. & ext. nasal nerves :
 - (a) the int. nasal nn. (med. & lat.) supplies the mucous memb. of upper part of nasal cavity
 - (b) the ext. nasal n. passes below the lower border of the nasal bone to supply the skin over the cartilaginous part of the nose.

(5) Infra-trochlear n. : the other terminal br. of nasociliary n. :

- it passes forwards above med. rectus m. then emerges from the orbit below the trochlea.
- it supplies the skin of the med. end of the 2 eye lids + the skin over the bony part of the nose.



CILIARY GANGLION

* Type : it is a small parasympathetic ganglion (1-2 mm in diameter)

* Site : in the post. part of the orbit (near the apex).

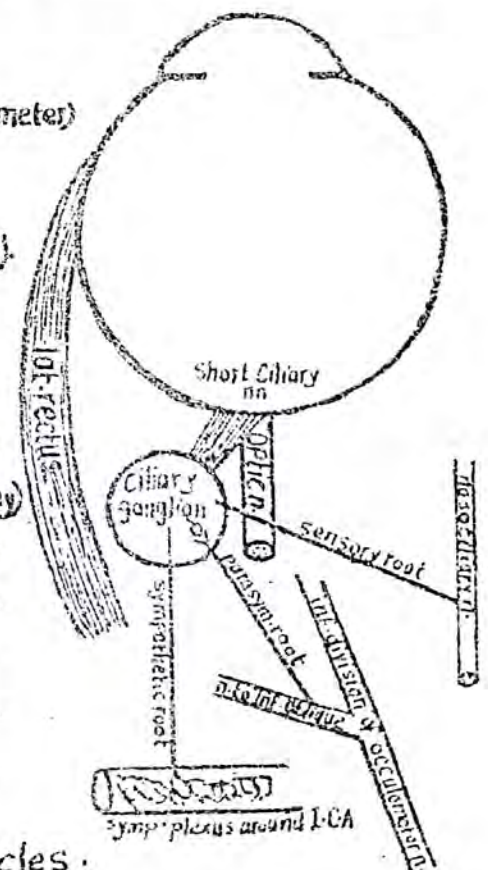
* Relations : it lies between optic n. (medially) & lat. rectus (laterally).

* Roots entering the ganglion :

- (1) Sensory root : br. from nasociliary n. (passes without relay).
- (2) Sympathetic root : from the int. carotid symp. plexus reaching the ganglion directly or joining the sensory root (passes without relay).
- (3) Para symp. root : from n. to inf. oblique (from inf. division of oculomotor n.) (Relays in the ganglion).

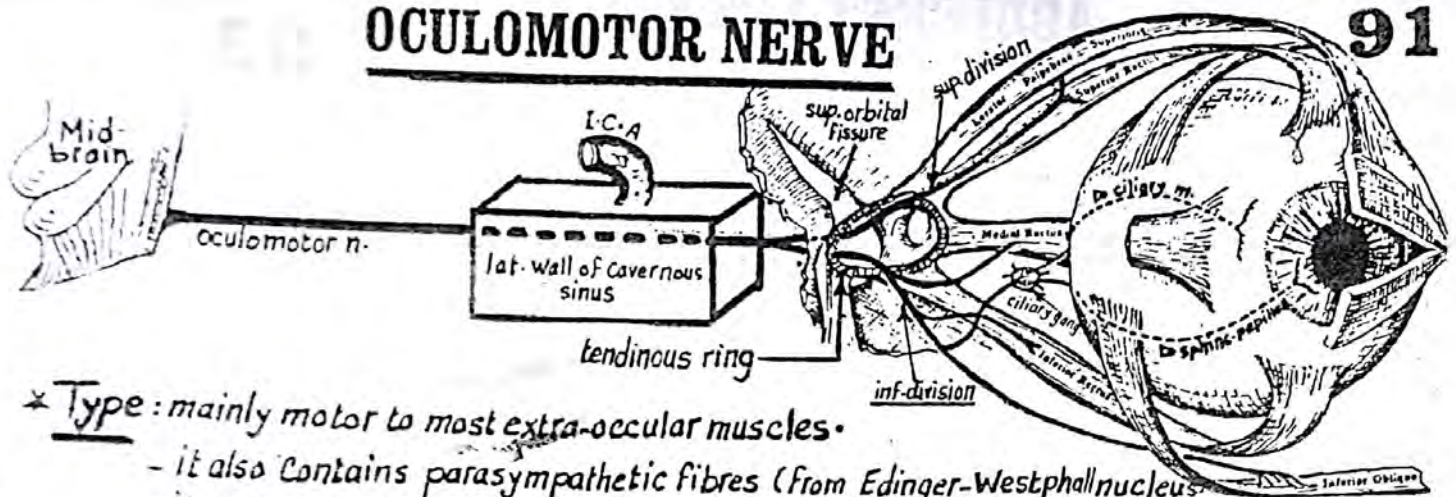
* Branches of the ganglion :

- 8-10 short ciliary n. which pierce the sclera around optic n.
- they supply : (1) Symp. fibres to the blood vessels of the eye.
- (2) Sensory fibres to the Cornea, iris & Choroid body.
- (3) para symp. to the sphincter pupillae & ciliary muscles.



OCULOMOTOR NERVE

91



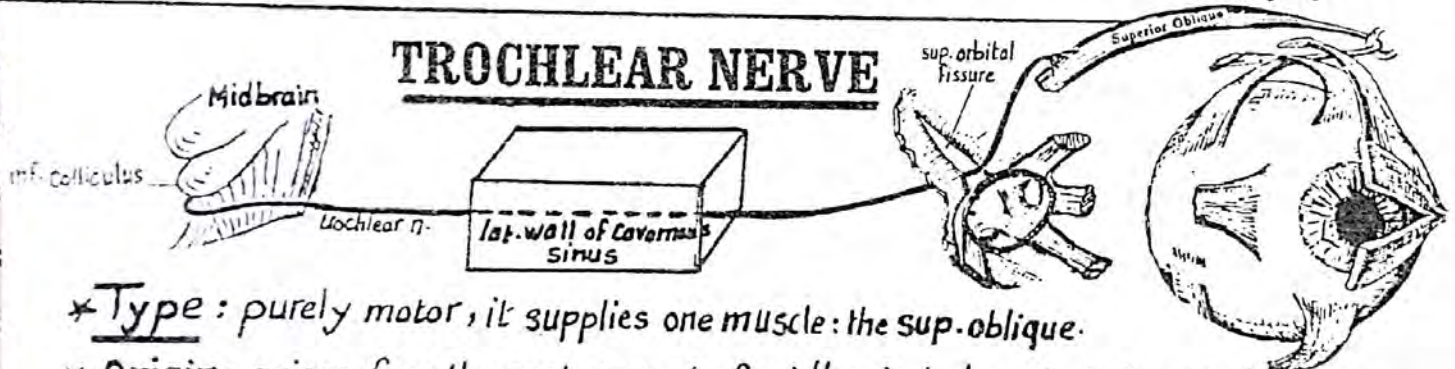
- * **Type** : mainly motor to most extra-ocular muscles.
 - it also contains parasympathetic fibres (from Edinger-Westphal nucleus).
 - it also contains sympathetic fibres (from the symp. plexus around I.C.A.).

- * **Origin** : arises from the med. aspect of the Cerebral peduncle of midbrain).
 - N.B : for the deep origin : see neuro anatomy.

* **Course & Relations** :

- (1) it pierces the dura mater in front of the point of decussation of the tentorium.
 - (2) it passes forwards in the lat. wall of Cavernous sinus above the trochlear n.
 - (3) then it enters the orbit through the sup. orbital fissure (inside the tendinous ring), where it divides into sup. & inf. divisions :
 - (a) the sup. division supplies : (1) Sup. rectus (2) levator palpebrae Superioris. (3) Symp. fibres to Muller's m.
 - (b) the inf. division supplies (1) inf. rectus (2) inf. oblique (3) med. rectus.
- N.B : the n. to inf. oblique gives a parasympathetic root to the ciliary ganglion.

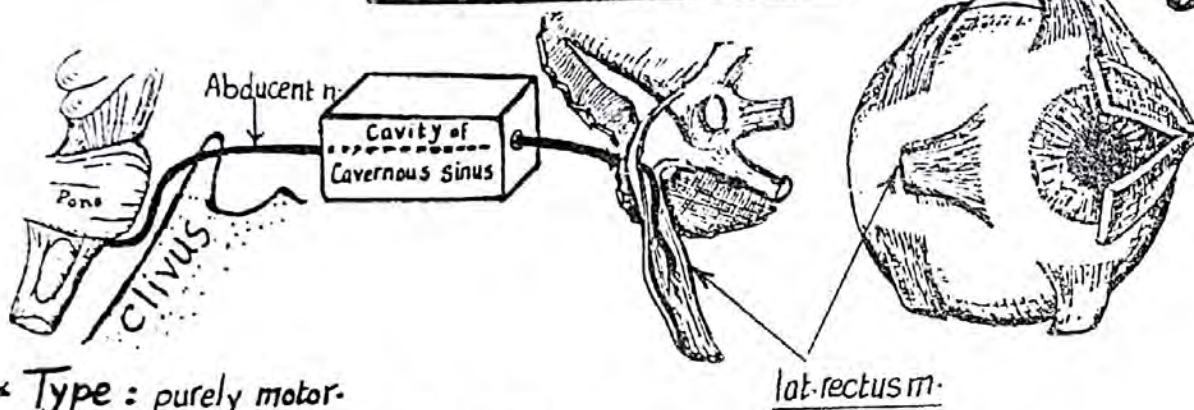
TROCHLEAR NERVE



- * **Type** : purely motor, it supplies one muscle: the sup. oblique.
- * **Origin** : arises from the post. aspect of midbrain below the inf. colliculus.
- * **Course** :
 - (1) It turns forwards around the midbrain.
 - (2) it pierces the dura mater at the point of decussation of the tentorium.
 - (3) it passes forwards in the lat. wall of cavernous sinus.
 - (4) Finally it enters the orbit through the sup. orbital fissure outside the tendinous ring.
- * **Termination** : it ends by entering the upper border of sup. oblique m. supplying it.

ABDUCENT NERVE

92



* **Type** : purely motor.

* **Origin** : from the lower border of the pons.

* **Course & relations** :

- (1) it ascends on the clivus then pierces the dura lat. to the dorsum sellae.
 - (2) it enters the Cavernous sinus traversing its cavity infero-lateral to the I.C.A.
 - (3) then it enters the orbit through the sup. orbital fissure (inside the tendinous ring).
- * it supplies the lat. rectus m. through its ocular (medial) surface.

OPHTHALMIC ARTERY

* **Origin** : From the I.C.A. after it emerges from the Cavernous sinus (at the ant. clinoid process).

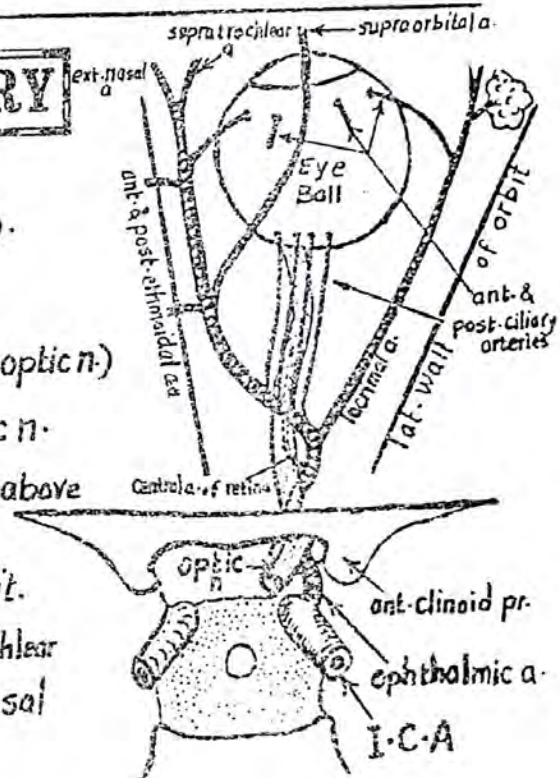
* **Course & relations** :

- (1) it enters the orbit through the optic Canal (below optic n.)
- (2) gradually it curves to reach the lat. side of optic n.
- (3) it reaches the lat. aspect of optic n. then crosses above it from lat. to medial.
- (4) then it runs forwards along the med. wall of orbit.

* **Termination** : it ends by dividing into supratrochlear
dorsal nasal

* **Branches** :

- (1) **Central a. of retina** (the most important br.) : it pierces the optic n. $\frac{1}{2}$ an inch behind the eye ball. It runs inside the optic n. to reach the retina (it is the only supply to it).
- (2) **Lacrimal a.** (the Largest br.) : accompanies lacrimal n. to reach the lacrimal gland.
- (3) **post & ant. ethmoidal aa.** : accompany post. & ant. ethmoidal nerves.
- (4) **post & ant. ciliary aa.** : to supply the eye ball.
- (5) **supratrochlear & supra orbital aa.** : accompany the corresponding nerves to reach the face.
- (6) **muscular & palpebral branches** : to the extraocular mm. & to the eye lids.
- (7) **dorsal nasal a.** (one of the 2 terminal branches) : to the dorsum of the nose.

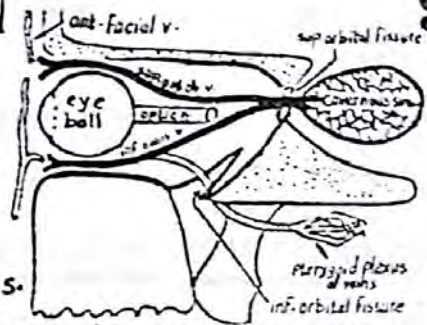


OPHTHALMIC VEINS

93

(1) Sup. ophthalmic V. :

- it is formed by tributaries corresponding to the branches of the ophthalmic artery.
- it runs backwards along ophthalmic a. above the optic n.
- it passes through the sup. orbital fissure to end in the cavernous s.
- it communicates anteriorly with the ant. facial v. & is regarded as the longest emissary v.



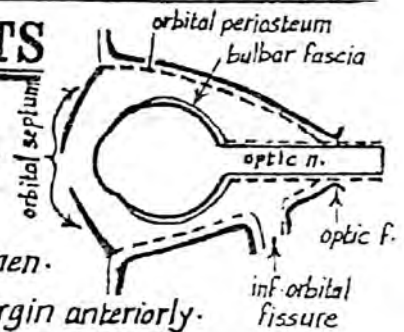
(2) inf. ophthalmic V. :

- it is formed by small veins in the ant. part of the floor of the orbit.
- it runs backwards below the optic nerve then leaves the orbit through sup. orb. fissure.
- it ends either in the sup. ophthalmic v. or opens separately in the cavernous sinus.
- it communicates with the pterygoid plexus via a vein passing through inf. orbital fissure.

ORBITAL FASCIA AND LIGAMENTS

(A) orbital periosteum:

- it is a funnel shaped sheath that encloses all the orbital contents except the infra orbital & zygomatic nerves.
- its apex is continuous with the dura matter at the optic foramen.
- its base is continuous with the pericranium at the orbital margin anteriorly.



(B) orbital Septum:

- it is the fibrous tissue stretching across the orbital opening & pierced by the palpebral fissure.
- it is fused with the tarsi of the eye lids & is continuous with the periosteum at the orbital margin.
- its upper part is pierced by: (1) tendon of levator palpebrae superioris (2) supra-orbital & supra-trochlear n. & vessels. (3) the palpebral part of the lacrimal gland.

(C) Bulbar fascia (Tenon's capsule):

- it is the membranous socket which envelopes the eye ball extending from the corneo-scleral junction anteriorly to the attachment of the optic nerve posteriorly.
- it is pierced by: (1) optic n. (2) tendons of the extra ocular mm. (3) ciliary vessels & nerves.

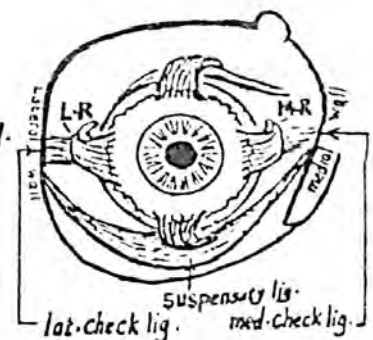
(D) Orbital ligaments:

(1) The suspensory ligament of the eye ball :

- it is a hammok-shaped fibrous band lying below the ant. part of the eye ball.
- its narrow ends are attached to the lacrimal bone (medially) & to the zygomatic bone (laterally). Its function is supporting the eye ball.

(2) The check ligaments (medial & lateral):

- these are 2 strong fibrous bands which connect the fibrous sleeves of the lat. & med. recti to the periosteum of the lat. & med. walls of the orbit respectively.
- they are so called because they limit the contractions of these 2 muscles.



Nasal Cavity

94

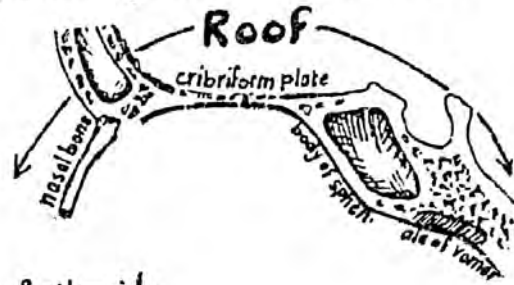
The Cavity of the nose is divided into Rt. & Lt. halves by the nasal septum.

* Each cavity opens on the face by the nostril & opens posteriorly onto the nasopharynx by the post-nasal aperture (Choana).

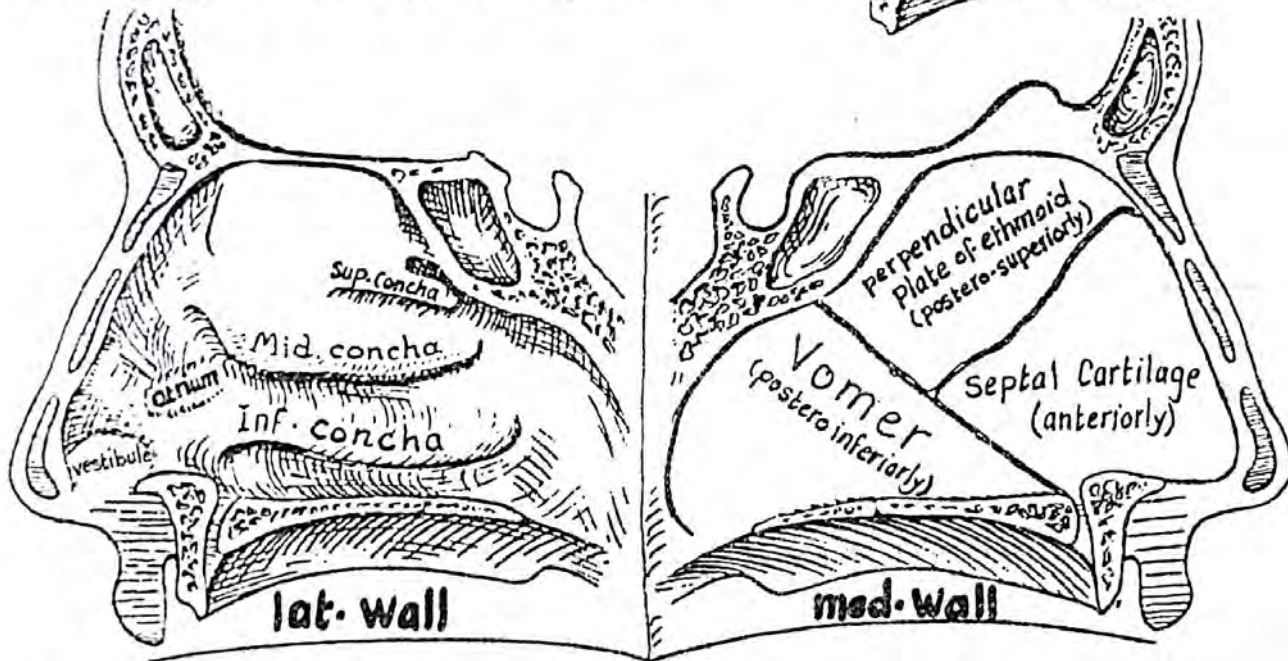
* Boundaries of the nasal cavity :

(1) The Roof : has the following parts:

- ant. sloping part : formed by the nasal bone.
- middle horizontal part : formed by cribriform plate of ethmoid.
- post. sloping part : formed by body of sphenoid + ala of vomer.



(2) The Floor : is formed by the hard palate.



(3) The medial wall (nasal Septum) : is formed by :

- septal Cartilage ----- anteriorly.
- perpendicular plate of ethmoid ----- postero superiorly.
- Vomer bone ----- postero inferiorly.

(4) The lateral wall : irregular & shows the following features :

- the Vestibule : a small dilatation above the nostril
- the atrium : a shallow depression above & behind the vestibule.
- the nasal conchae :

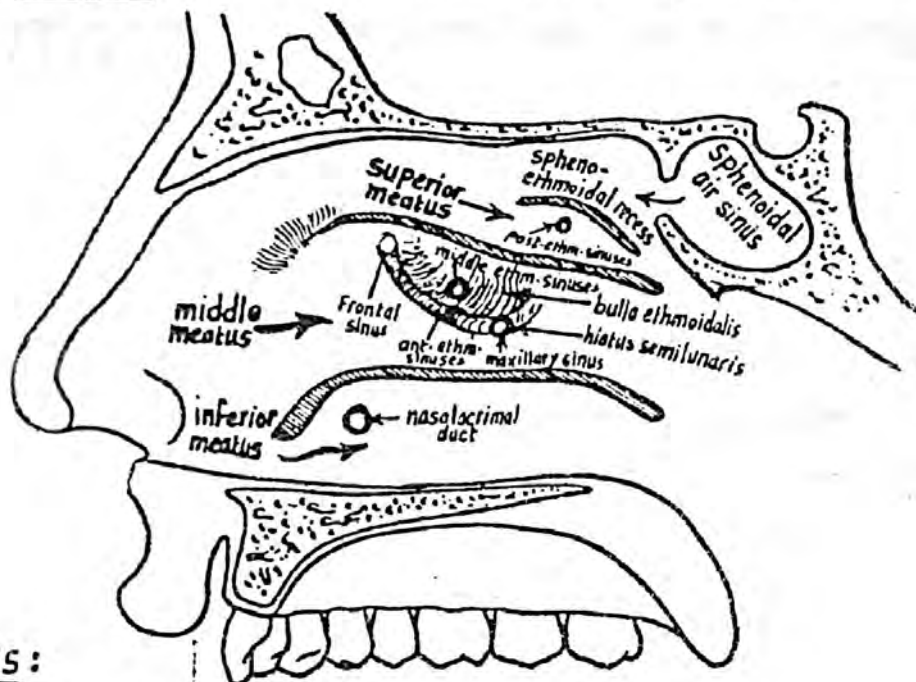
— the conchae are 3 shelf-like elevations separated by spaces called meatuses:

- the sup. concha : is the smallest one & is part of the ethmoid bone.
- the middle » : is medium sized & is also a part of the ethmoid bone.
- the inferior » : is the largest of all & is a separate bone.

N.B : the conchae are covered by a thick highly vascular mucous membrane.

(d) Nasal meatuses: below each concha there is a space called meatus:

95



(1) Sup. meatus:

- is a narrow space lying below the sup. concha.
- it receives the openings of the post. ethmoidal air sinuses.

(2) middle meatus: lies below the middle concha & shows the following features:

- (a) bulla ethmoidalis: a rounded elevation on which open the middle ethm. air sinuses.
- (b) hiatus semilunaris: a crescentic groove below the bulla receiving the openings of:
 - (1) ant. ethm. air sinuses (2) Frontal air sinus (3) Maxillary air sinus (arranged from before backwards).

(3) inferior meatus: runs below the inf. concha & receives the opening of nasolac. duct.

(4) Spheno-ethmoidal recess: a triangular fossa between the sup. concha & the roof of the nose. It receives the opening of the sphenoidal air sinus.

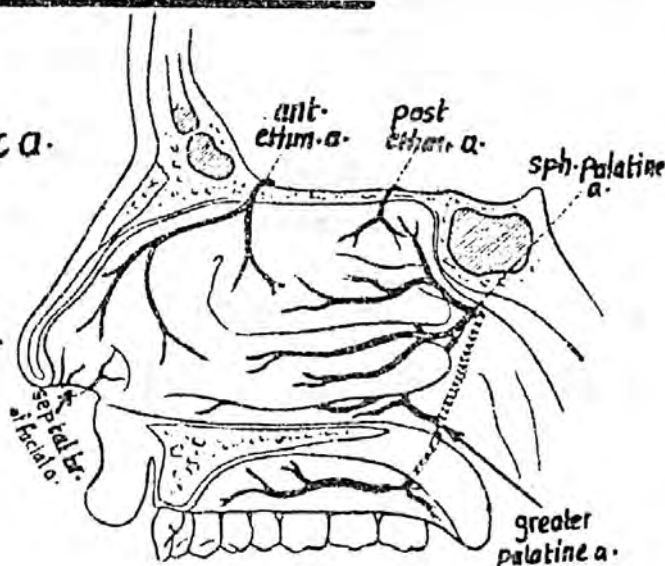
BLOOD SUPPLY OF THE NASAL CAVITY

(A) Arterial Supply:

- (1) ant. & post. ethmoidal branches of ophthalmic a.
- (2) sphenopalatine branch of maxillary a.
- (3) greater palatine " " " "
- (4) Septal br. of the sup. labial br. of facial a.

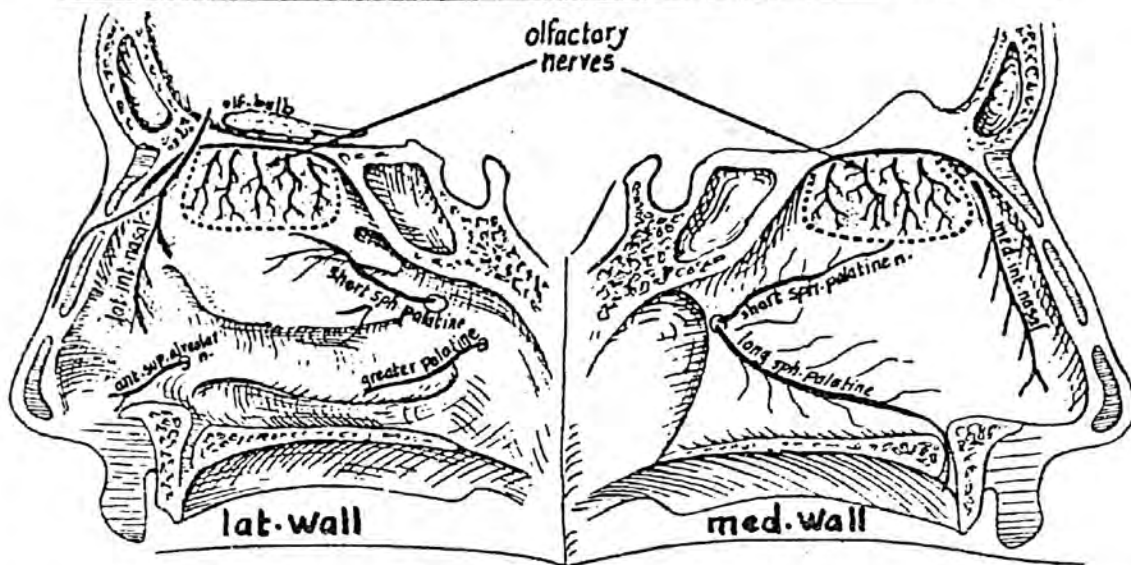
(B) Venous drainage:

by veins accompanying the arteries
with rich arterio-venous shunts.



NERVE SUPPLY OF THE NASAL CAVITY

96



Nerves supplying the lat. wall	Nerves supplying the med. wall (nasal septum)
<u>Olfactory nerves</u> : Carrying smell sensation from the olfactory mucosa in the upper part (roof)	(A) <u>Olfactory nerves</u> : Carry smell sensation from the olfactory mucosa in the upper part (roof).
(B) <u>Branches of trigeminal n.</u> Carry general sensation (1) <u>lat. int. nasal br. of ant. ethmoidal n.</u> : supply the ant. sup. part. (2) <u>nasal br. of ant. sup. alveolar n.</u> : supplies the ant. inf. part. (3) <u>Short sphenopalatine n.</u> : supplies the post. sup. part. (4) <u>greater palatine n.</u> : supplies the post. inf. part.	(B) <u>Branches of trigeminal n.</u> (Carry general sensation) (1) <u>med. int. nasal br. of ant. ethmoidal n.</u> : supplies the ant. part. (2) <u>long sphenopalatine n.</u> supplies the post. inf. part. (3) <u>short sphenopalatine n.</u> supplies the post. sup. part.

LYMPHATIC DRAINAGE OF NASAL CAVITY

- * the ant. part : drains into the submandibular lymph nodes
- * the post. part : " " " retro pharyngeal & upper deep cervical L.Ns.

PARANASAL AIR SINUSES

97

* **Definition:** they are air-filled spaces inside the skull bones related to the nose & they open in the lat. wall of the nasal cavity.

* **Functions:** (1) diminish the weight of the skull.

(2) give resonance to the voice.

(3) warming & humidification of air

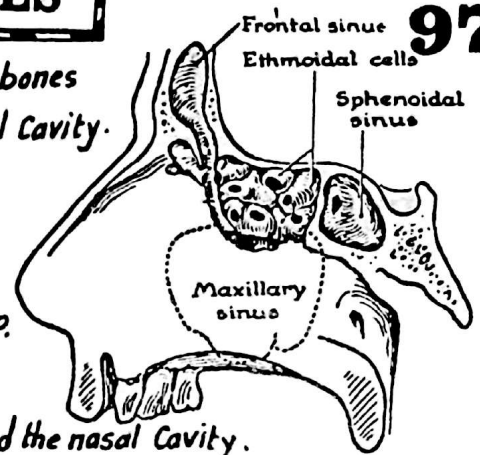
(4) protection of the brain against changes of temp.

* **Paranasal sinuses include:**

(1) Sphenoidal air sinus: inside the body of sphenoid behind the nasal cavity. it opens into the post. part of the spheno-ethmoidal recess.

(2) Frontal air sinuses: one behind each superciliary arch above the nose. it opens into the hiatus semilunaris of the middle meatus of the nose.

(3) Ethmoidal air sinuses: include ant, middle & post. groups inside the ethmoidal labyrinth. The post. group opens into the sup. meatus while the rest open into the middle meatus.



4 - MAXILLARY AIR SINUS

* **Site:** it fills the whole of the body of maxilla.

* **Size:** it is the largest of all paranasal sinuses.

* **Shape & relations:** it is pyramidal in shape having:

(1) apex: lies at the zygomatic process of maxilla.

(2) base: directed medially & formed by the lat. wall of the nasal cavity & contains the opening of the sinus.

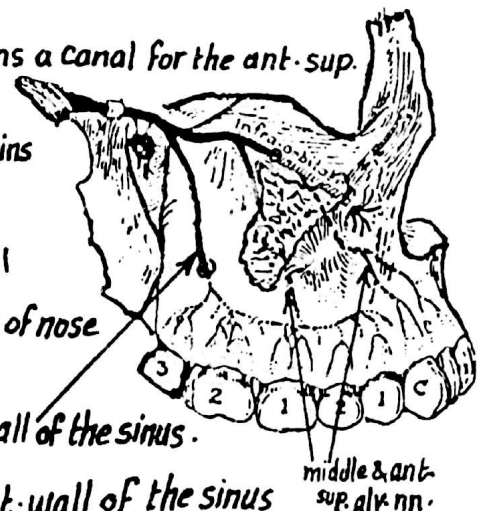
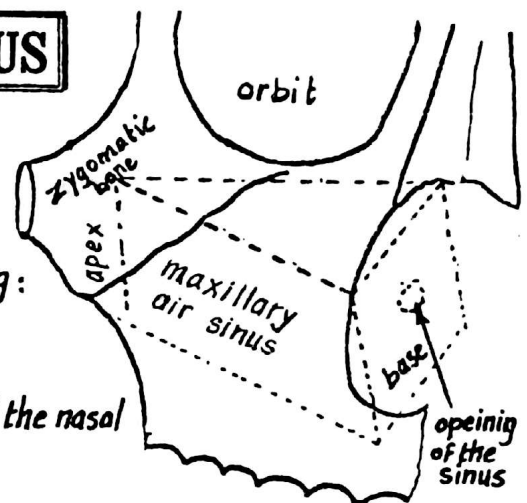
(3) roof: formed by the orbital plate of maxilla separating the sinus from the orbit. The roof is traversed by the infra-orbital canal.

(4) floor: formed by the alveolar process of maxilla.

(5) ant. wall: formed by the ant. surface of maxilla & contains a canal for the ant. sup. alveolar n. (Canalis sinosus).

(6) Post. wall: formed by the post. surface of maxilla & contains the post. sup. alveolar f. for the post. sup. alveolar n.

* **Opening of the Sinus:** situated high up in the med. wall (base) & opens into the hiatus semilunaris of middle meatus of nose.



* **Nerves related to the sinus:**

(1) Post. sup. alveolar n.: runs in bony canal in the post. wall of the sinus.

(2) middle sup. alveolar n. } run in bony canals in the ant. wall of the sinus

(3) ant. sup. alveolar n. }

(4) infra-orbital n.: traverses the infra-orbital canal in the roof of the sinus.

* **Nerve supply:** infra-orbital n., sup. alveolar n. & greater palatine n.

THE NECK

98

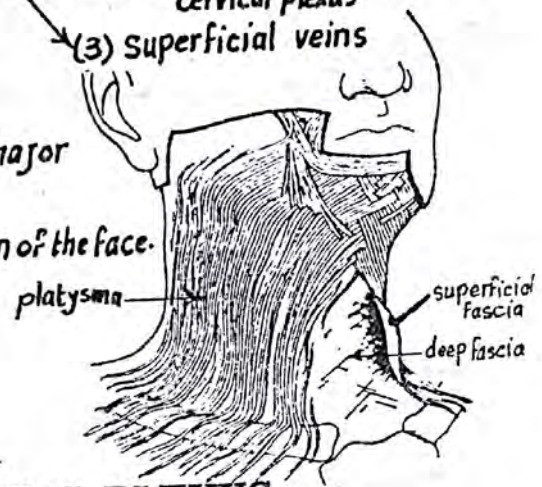
I- **SUPERFICIAL FASCIA**

contains

- (1) Platysma m.
- (2) cutaneous branches of the cervical plexus
- (3) superficial veins

A- **PLATYSMA M.**

- Origin: From the deep fascia covering pectoralis major & deltoid muscles.
- Insertion: into the lower border of mandible & skin of the face.
- N. supply: Cervical branch of facial n.
- Action: (1) it wrinkles the skin of the neck.
(2) it helps to depress the mandible.



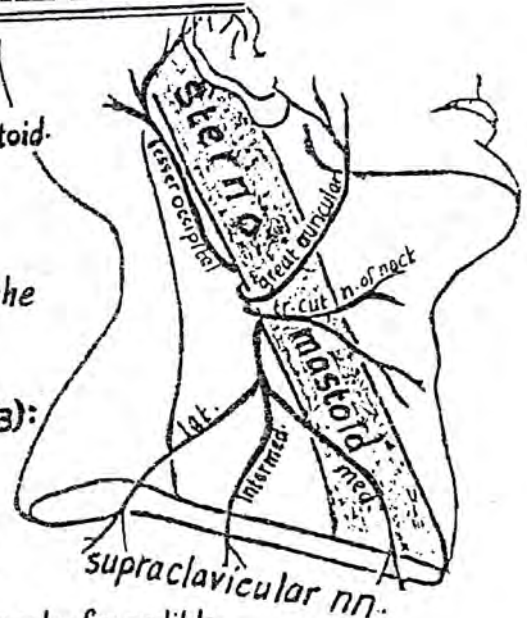
B- **CUTANEOUS BRANCHES OF CERVICAL PLEXUS**

(1) Lesser occipital n. (from ant. ramus of C₂):

- it appears at the middle of post. border of sternomastoid.
- it ascends along the post. border of sternomastoid towards the mastoid process.
- it supplies the skin of the upper 1/2 of inner surface of the auricle + the adjoining part of the scalp.

(2) The Great auricular n. (from ant. ramus of C₂ & C₃):

- appears at the middle of the post. border of sternomastoid
- it passes upwards & forwards superficial to sternomastoid (deep to the ext. jugular v.) towards angle of mandible.
- it supplies: (1) the skin over the angle of mandible. (2) skin over the parotid gland.
(3) the skin of the lower 1/2 of the outer & inner surfaces of the auricle.



(3) the transverse (anterior) cutaneous n. of neck (from C₂, 3)

- it appears at the middle of the post. border of sternomastoid m.
- it runs transversely forwards superficial to sternomastoid (deep to ext. jug. v.)
- it divides into upper & lower branches supplying the skin of the ant. Δ of neck.

(4) the supraclavicular nerve (from C₃, 4):

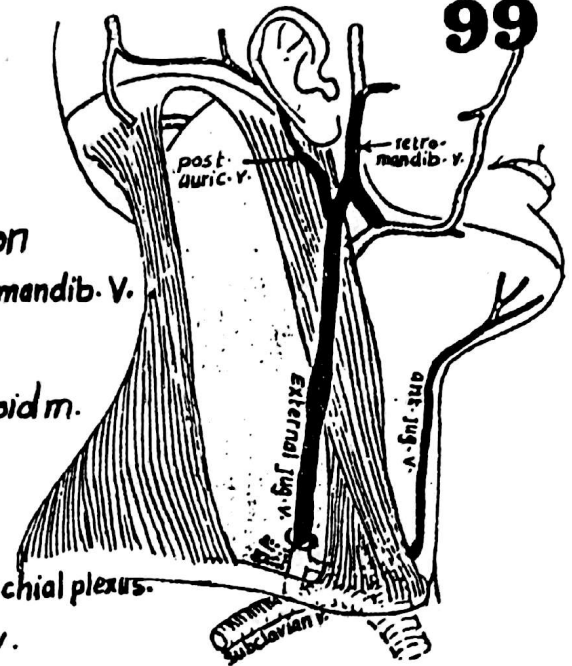
- appears about the middle of the post. border of sternomastoid m.
- it divides into 3 branches (med., intermediate & lat.) which descend superficial to the clavicle supplying: (1) skin of the post. Δ of neck (2) skin over tip of shoulder
(3) skin of chest as far down as the sternal angle (2nd rib).

C-SUPERFICIAL VEINS:

99

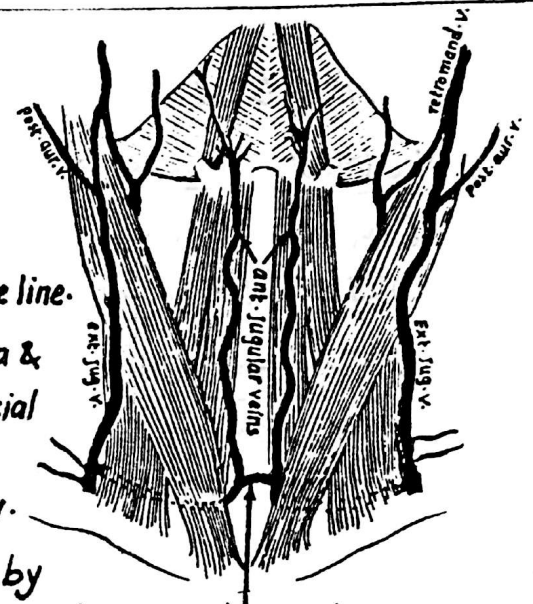
(1) External jugular vein:

- it begins below the angle of mandible by union of 2 veins: the post-auricular & post. division of retromandib. V.
- Course & relations:
 - (1) it runs downwards superficial to the sternomastoid m. towards the midclavicular point.
 - (2) One inch above the clavicle, it pierces the deep fascia (its wall fusing with it) & descend in front of brachial plexus.
- termination: it ends by joining the subclavian v.
- tributaries: (1) ant-jugular v. (2) transverse cervical v. (3) suprascapular v.



(2) Anterior jugular vein:

- it begins near the hyoid bone by union of small veins.
- Course & relations:
 - (1) it descends in the superficial fascia close to middle line.
 - (2) just above the sternum, it pierces the deep fascia & turns backwards deep to sternomastoid & superficial to scalenus ant. to reach the post. Δ of the neck
- termination: it ends by joining the ext-jugular v.
- N.B: the Rt. & Lt. ant-jugular veins are connected by a transverse channel just above the sternum called the Jugular arch



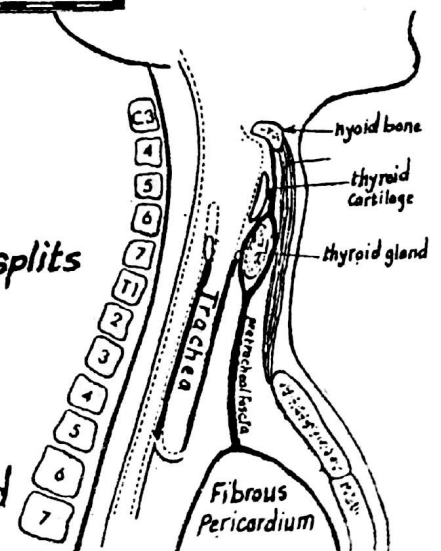
II- DEEP FASCIA OF NECK

(1) PRETRACHEAL FASCIA

*Site: it lies deep to the infra-hyoid muscles

*attachments:

- above: attached to hyoid bone & thyroid cartilage, it splits to enclose the thyroid gland.
- below: it descends into the thorax to blend with the fibrous pericardium.
- on each side: it is continuous laterally with Carotid sheath.



2-CAROTID SHEATH

100

* definition : it is a tubular sheath of dense fibrous tissue deep to the post. border of sternomastoid extending from the base of skull above to the arch of aorta below.

* attachments :

- (1) above : to the base of skull around the carotid & jugular foramen.
- (2) below : it blends with the adventitia of the arch of aorta.
- (3) anteriorly : it is continuous with the pretracheal fascia.
- (4) posteriorly : " " " " prevertebral fascia.

* Contents :

(A) in the upper part (above the post. belly of digastric) :

- (1) I.C.A (anteromedially). (2) I.J.V (posterolaterally).
- (3) the lower 4 Cranial nerves 9, 10, 11 & 12 (inbetween the V. & the a.)

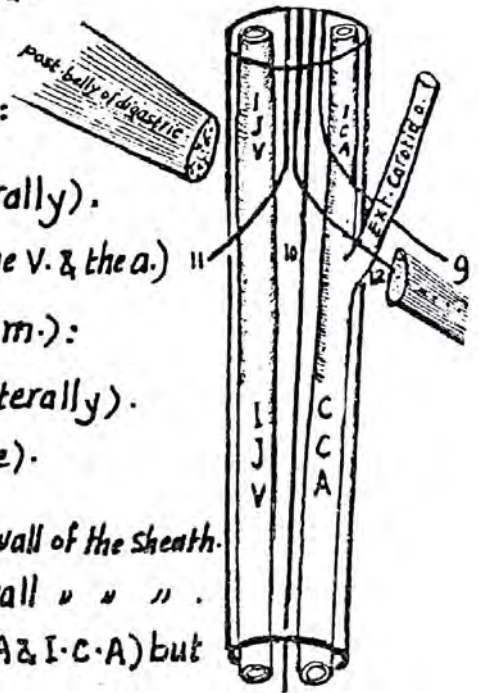
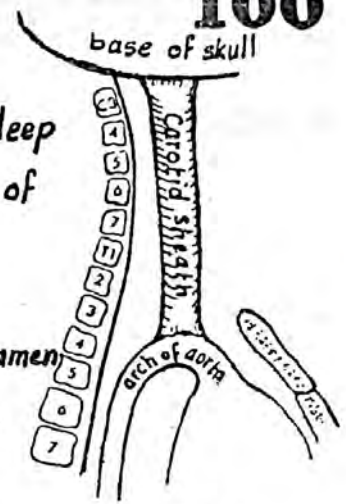
(B) in the lower part (below the post. belly of digastric m.) :

- (1) C.C.A (anteromedially). (2) I.J.V (posterolaterally).
- (3) Vagus n. (inbetween the artery & vein, at post. plane).

N.B : (1) the sympathetic chain : is embedded in the post. wall of the sheath.

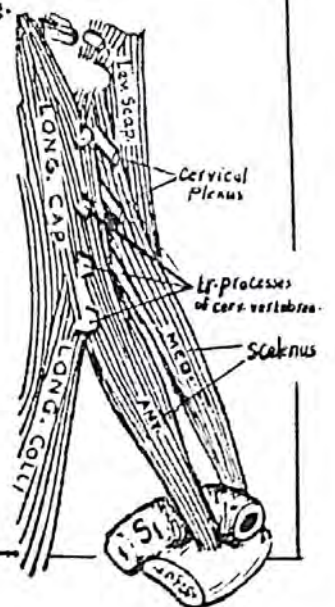
(2) the 2 limbs of ansa cervicalis are " " " ant. wall " " " .

(3) the Carotid sheath is thick over the artery (C.C.A & I.C.A) but thin over the I.J.V. (to allow its distension).



* Relations of the Carotid Sheath

superficial relations	deep relations
(1) skin, superficial fascia & deep fascia. (2) Sternomastoid (all through). (3) post. belly of digastric m. (4) infra hyoid mm. (in the lower part). (5) deep cervical lymph nodes (6) Styloid apparatus & parotid gland (in the upper part)	(1) tr. processes of cervical vertebrae. (2) prevertebral muscles : longus Capitis & longus Colli (3) lat. vertebral muscles : levator scapulae, scalenus ant. & medius. (4) Cervical plexus of nerves (5) 1st part of subclavian a.



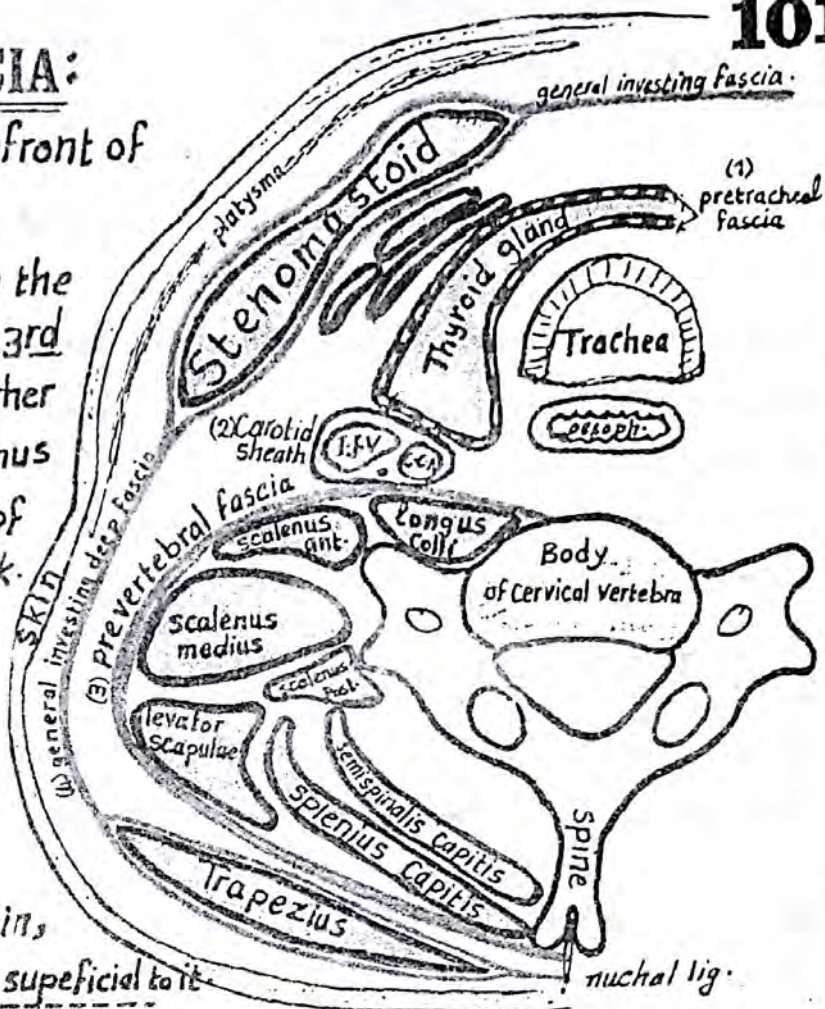
3-PREVERTEBRAL FASCIA:

- it is a firm sheet which lies in front of the prevertebral muscles.

- Extensions: it extends from the base of skull to the level of the 3rd thoracic vertebra below. On either side, it extends across the scalenus ant. m. then covers the muscles of the floor of post. triangle of neck.

- Relations:

- (1) the roots of the cervical & brachial plexus and its trunks & 3rd part of subclavian a. lie deep to it
- (2) the subclavian v., ext. jug. vein, accessory n. & L.Ns of post. Δ lie superficial to it.



Transverse section in the neck

4-GENERAL INVESTING DEEP FASCIA:

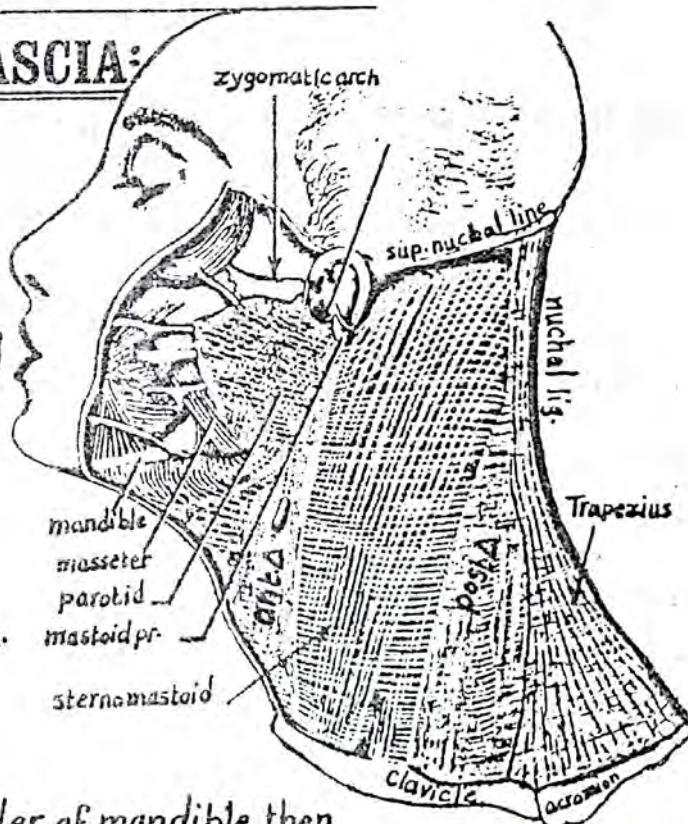
- it is the outer fascia which surrounds the neck like a collar.
- it forms the roof of the ant. & post. triangles of the neck & splits to enclose the sternomastoid & trapezius muscles

- Attachments:

- (1) posteriorly: to the nuchal lig.
- (2) anteriorly: to the hyoid bone & thyroid cartilage.
- (3) inferiorly: to manubrium, clavicle, acromion & spine of scapula.
- (4) superiorly: it is attached to the lower border of mandible then

splits to enclose the parotid (forming a capsule to it) then becomes attached to:

- the ant. & inf. borders of the ext. auditory meatus
- the mastoid process & sup. nuchal line.
- to the ext. occipital protuberance.



5-PAROTID FASCIA

102

- it is derived from the general investing deep fascia of the neck which splits at the lower end of the parotid gland into 2 layers : superficial & deep which enclose the gland :

- (a) the superficial layer: extends upwards superficial to the parotid gland & masseter m. to become attached to the zygomatic arch.
- (b) the deep layer: passes deep to the parotid and becomes attached to the petrous temporal bone, styloid & mastoid processes. The part of the deep layer extending between the angle of mandible & Styloid process is called the stylomandibular lig.

(6) PHARYNGEO BASILAR FASCIA

it is a very tough fascia connecting the muscular wall of the pharynx to the base of skull. It keeps the nasopharynx always patent for breathing.

(7) BUCCO-PHARYNGEAL FASCIA

it covers the outer surface of the buccinator m. & extends to cover the outer surface of the constrictor muscles of the pharynx.

(8) SUPRA-PLEURAL MEMBRANE

- it is a strong fan-shaped sheet of fascia covering the apex of lung at the root of the neck.
- the apex of the fan is attached to the tr. process of the 7th cervical vertebra.
- the base " " " " " " " " inner border of the 1st rib.

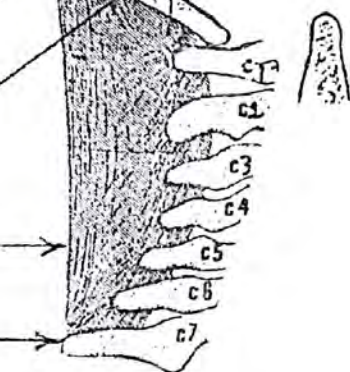
(9) Ligamentum Nuchae

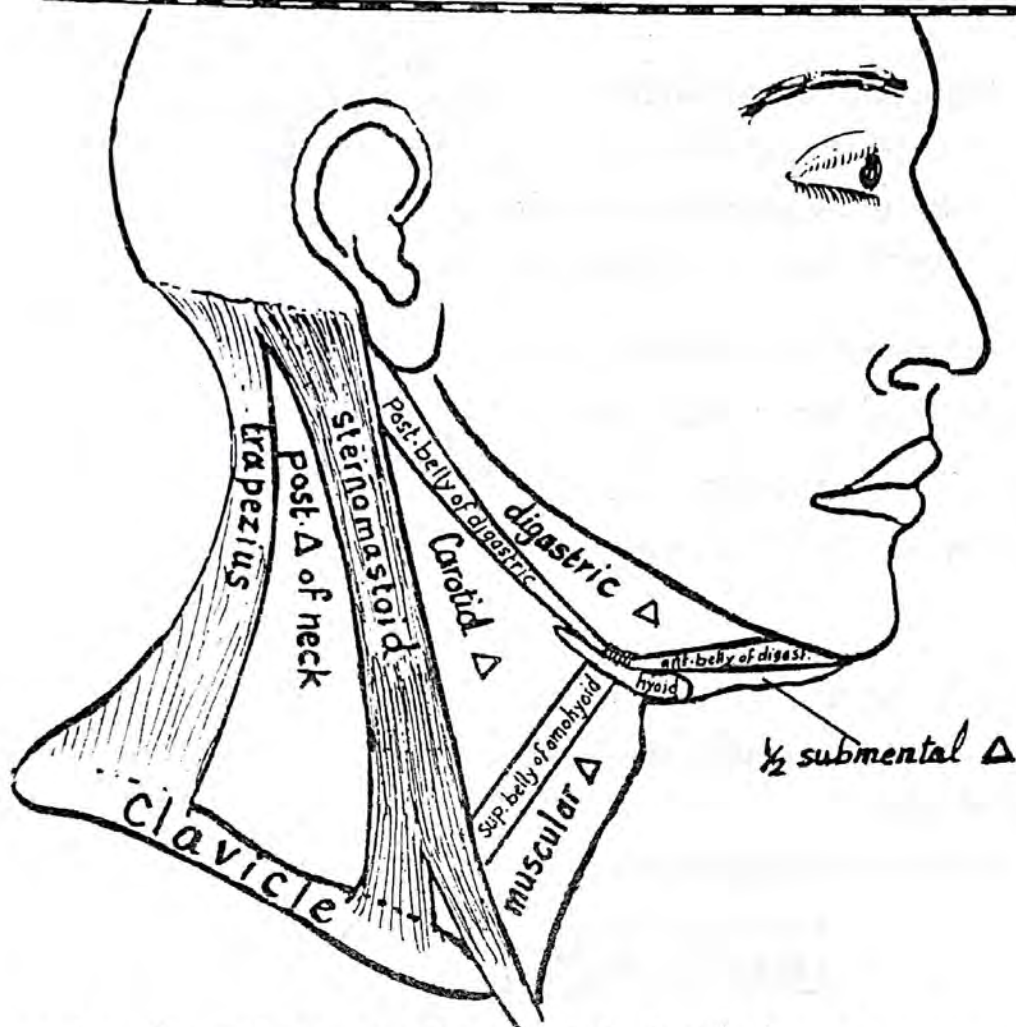
- * It is a triangular strong median fibrous septum stretching between the muscles of both sides of the back of the neck.
- * It represents the upward continuation of the supraspinous & interspinous ligaments.

* Attachments :

- (1) its base : is attached above to
- (2) its ant. border : " to all cervical spines
- (3) " post " : is free
- (4) Its Apex : is attached below to the spine of C7

ext. occipital protuberance
" " crest





- The anterolateral aspect of the neck is divided by the sternomastoid m. into 2 large triangles : the post. Δ & the ant. Δ.
- the post. Δ is bounded by : the post. border of sternomastoid ----- anteriorly.
the ant. border of trapezius m. ----- posteriorly.
the middle $\frac{1}{3}$ of clavicle ----- below.
- the ant. Δ is bounded by :
 - ant. border of sternomastoid ----- posteriorly.
 - middle line of the neck ----- anteriorly.
 - the lower border of mandible ----- above.
- Subdivisions of the ant. Δ of neck :
each ant. Δ is subdivided by the muscles attached to the hyoid bone (the digastric m. & the sup. belly of omohyoid) into $3\frac{1}{2}$ triangles :
 - the digastric Δ
 - the Carotid Δ
 - the muscular Δ
 - & - $\frac{1}{2}$ submental Δ

STERNOMASTOID MUSCLE

104

* Origin : by 2 heads :

- (1) Sternal head : rounded tendon from the front of manubrium sterni
- (2) Clavicular head : flat fleshy head from the med. $\frac{1}{3}$ of upper surface of the clavicle.

- ## * Insertion :
- (1) lat. surface of mastoid process.
 - (2) lat. $\frac{1}{3}$ of sup. nuchal line

- ## * N. Supply :
- (1) spinal accessory n. (motor).
 - (2) branches from C_{2,3} (proprioceptive)

* Action :

- (1) when one muscle contracts : it bends the head towards its same side & turns the face to the opposite side.
- (2) when the 2 muscles act together they flex the neck.

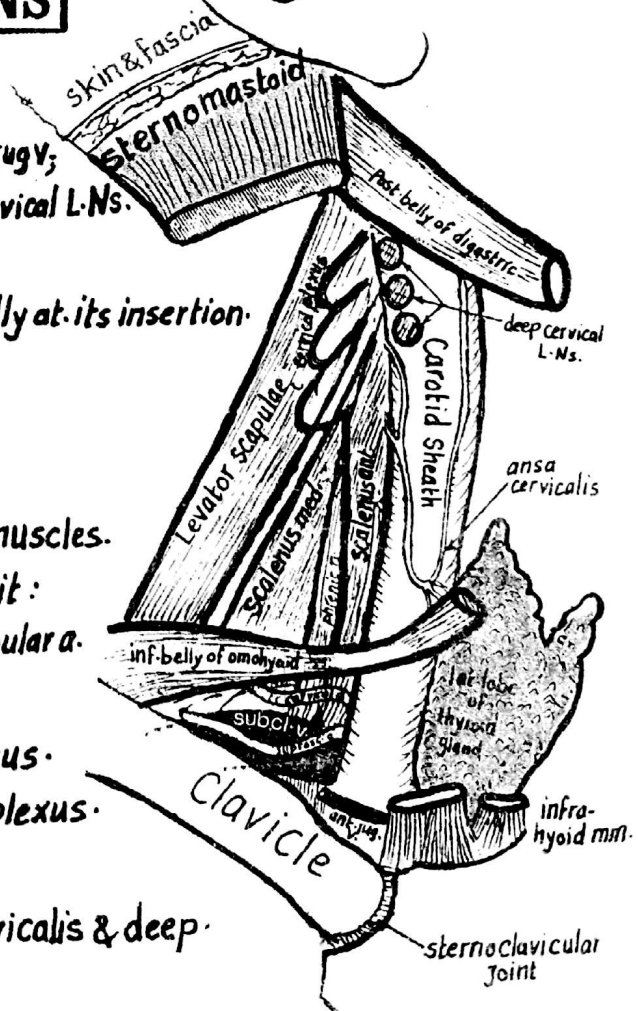
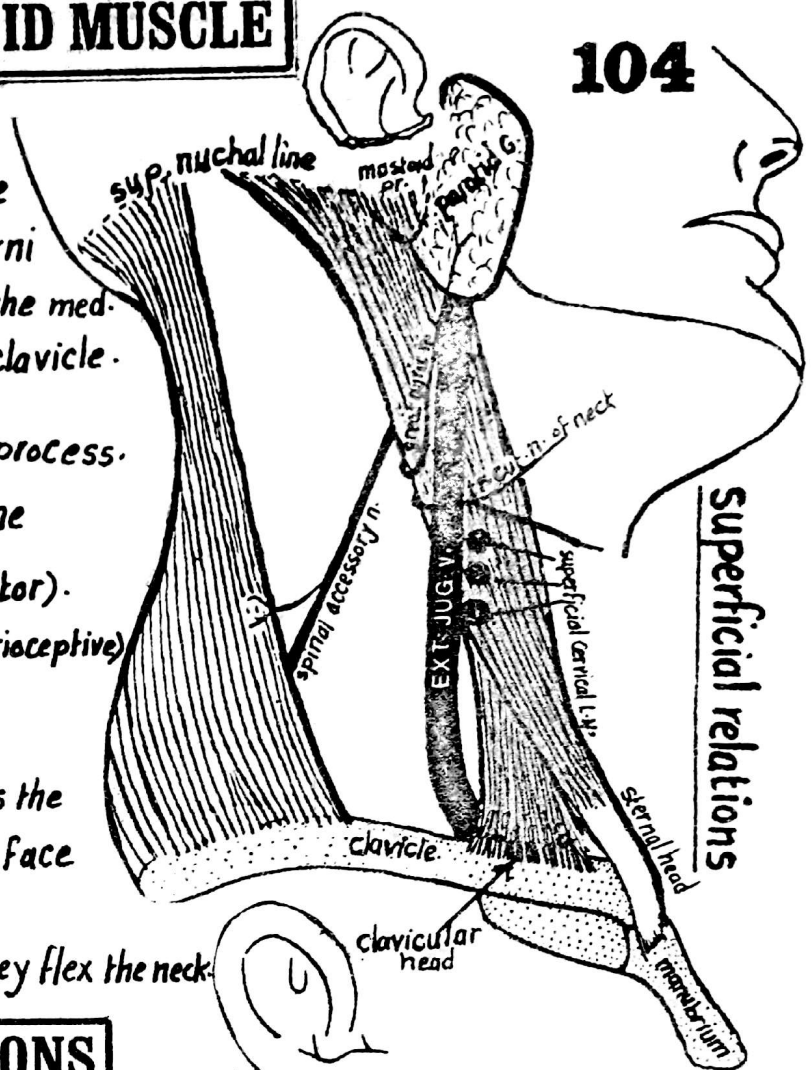
* RELATIONS

(A) Superficial relations :

- (1) skin & s. fascia containing : platysma, ext. jug v., great auricular & tr. cut. nn. & superficial cervical L.Ns.
- (2) deep fascia.
- (3) parotid gland covering the muscle partially at its insertion.

(B) Deep relations :

- (1) Sterno clavicular joint.
- (2) Sternohyoid, Sternothyroid & omohyoid muscles.
- (3) Scalenus ant. & the structures in front of it :
 - (a) phrenic n. (b) tr. cervical a. (c) suprascapular a.
 - (d) ant. jugular v. & (e) subclavian v.
- (4) Scalenus medius & roots of brachial plexus.
- (5) levator scapulae & roots of the cervical plexus.
- (6) lateral lobe of the thyroid gland.
- (7) Carotid sheath & its contents, ansa Cervicalis & deep cervical lymph nodes.



(C) The ant. border : forms the post. boundary of the ant. Δ of the neck

(D) The post. border : forms the ant. boundary of the post. Δ of neck. The following nerves appear from beneath this border :

- (1) lesser occipital n. (2) great auricular n (3) tr. cutaneous n. of neck,
(4) supraclavicular n. (5) spinal accessory n.

(E) the spinal accessory n. pierces the upper part of the muscle

SCALENUS ANTERIOR MUSCLE

* Origin: by 4 slips from the ant. tubercles of the transverse processes of C 3, 4, 5, 6 vertebrae.

* Insertion: into scalene tubercle on the inner border of 1st rib.

* N-Supply: from ant. 1st rami of C4, 5, 6

* Action: (1) flexion of the neck forwards & laterally.
(2) elevation of the 1st rib (during forced inspiration).

Relations of Scalenus anterior

I- Anterior relations:

(one nerve, 2 muscles, 2 small arteries & 2 large vv. & 1 small v.)

(1) phrenic n. : runs vertically in front of the muscle crossing it from lateral to medial. It lies between the muscle & the prevertebral fascia.

(2) Sternomastoid m. overlapping scalenus ant. completely.

(3) inf. belly of omohyoid m.

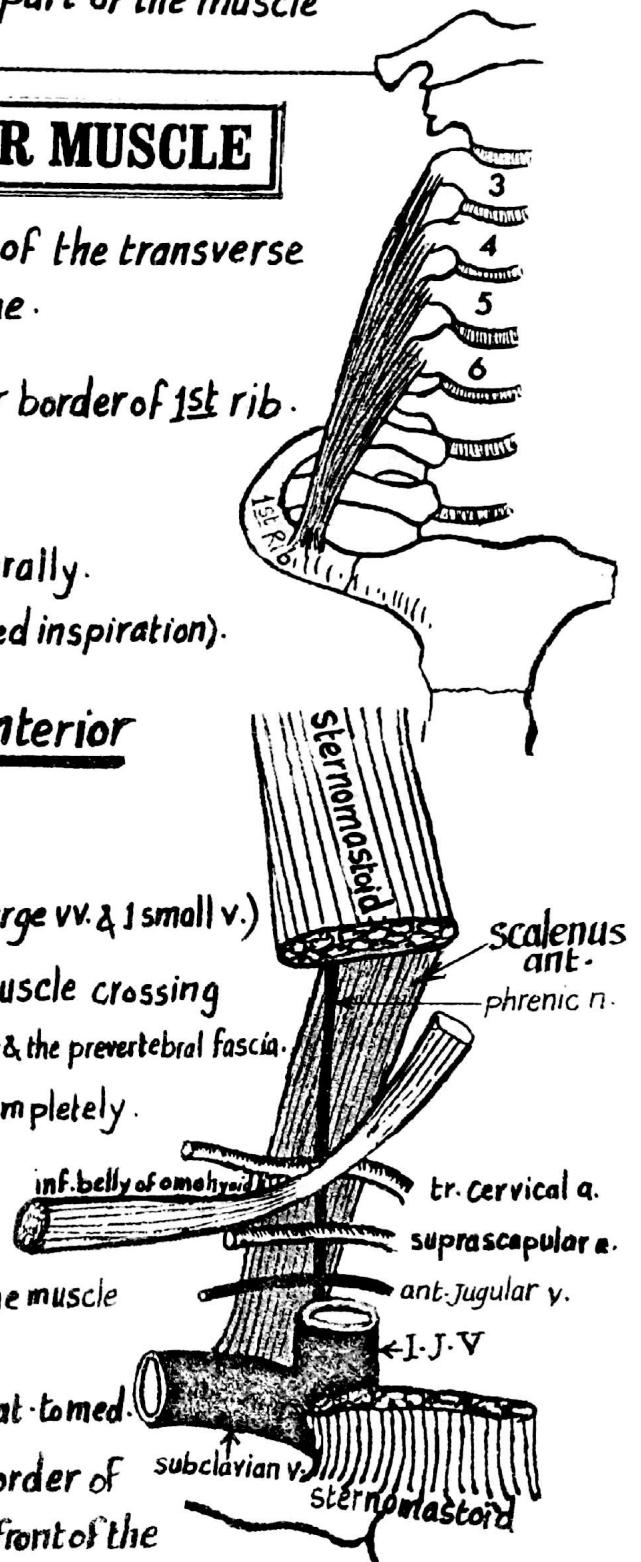
(4) supra scapular a.

(5) transverse cervical a. } cross the lower part of the muscle from med. to lat.

(6) subclavian v. : crosses the lowermost part from lat. to med.

(7) Int. jugular v. : descends in front of the med. border of muscle to unite with the subclavian v. in front of the lower end of the muscle.

(8) ant. jugular V. : crosses in front of the lower end of the m. to reach the post. Δ .

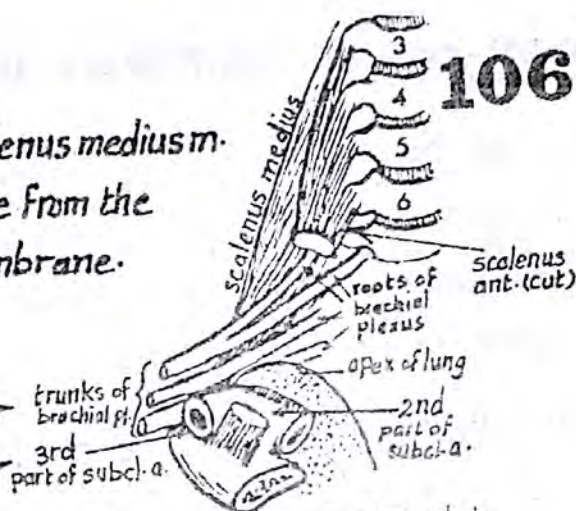


I- Posterior relations :

- (1) roots of brachial plexus separating it from scalenus medius m.
- (2) 2nd part of subclavian a. separating the muscle from the apex of lung, cervical pleura & suprapleural membrane.

II- Lateral relations :

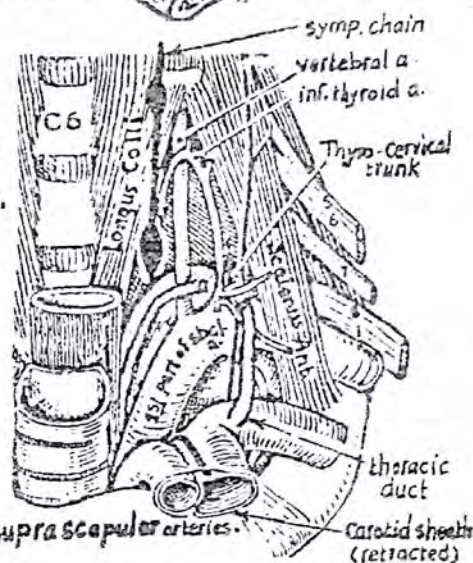
- (1) trunks of the brachial plexus
- (2) 3rd part of subclavian a.



III- Medial relations : (Contents of the vertebral Δ).

the vertebral Δ is an inverted v-shaped space between the longus colli (cervicis) medially & scalenus ant. laterally. it contains the following structures :

- (1) 1st part of subclavian a. (at the base of the Δ).
- (2) vertebral a. : arising from 1st part of subclavian a. & ascending to the apex of the Δ.
- (3) thyro-cervical trunk : ascending along the med. border of scalenus ant. & dividing into : inf. thyroid, br. cervical & supra scapular arteries.
- (4) sympathetic chain : descending in the med. part of the Δ.
- (5) Thoracic duct (on the Lt. side only) : arches in front of the vertebral vessels from med. to lat.



THE OTHER THREE SCALENE MUSCLES

- (1) Scalenus medius : (the largest of all scalene muscles).

Origin : from the post. tubercles of all cervical vertebrae.

Insertion : into upper surface of 1st rib behind the subclavian groove.

N. supply : from all cervical nerves.

Action : (1) Flexion of cervical vertebrae (2) Fixation of 1st rib.



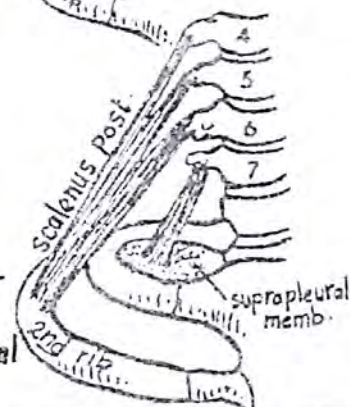
- (2) Scalenus posterior (the smallest of all scalene muscles) :

Origin : from the post tubercles of C 4, 5, 6 vertebrae.

Insertion : outer surface of 2nd rib behind the serrate tubercle.

N. supply : From C 4, 5, 6 Cervical nerves.

Action : (1) lat. flexion of the neck (2) Fixation of the 2nd rib.

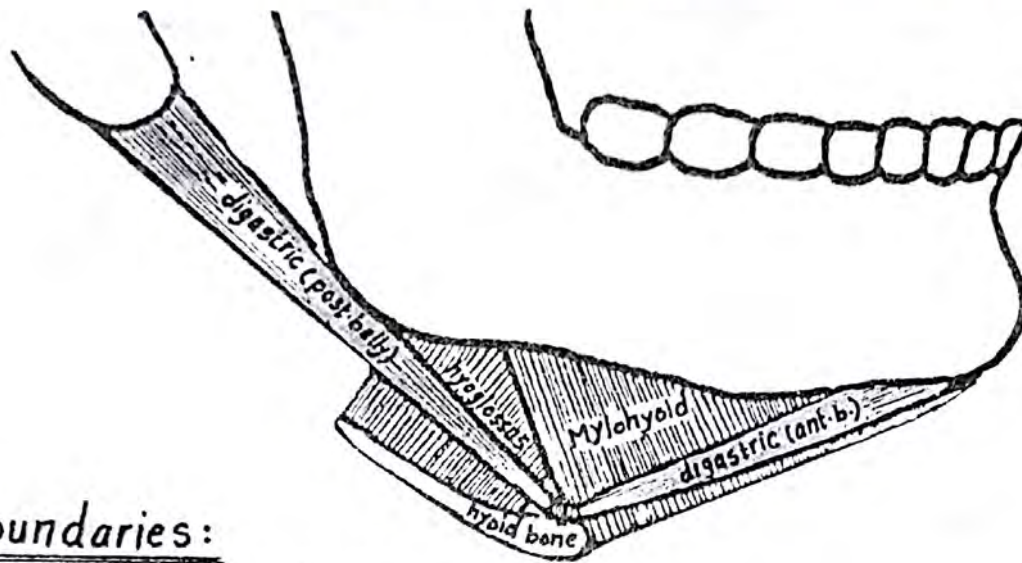


- (3) Scalenus minimus : it is a very small m. arising from tr. process of C7. & inserted into the suprapleural membrane. Action : It tightens the suprapleural membrane.

PREVERTEBRAL MUSCLES : see page 190

DIGASTRIC TRIANGLE & SUBMANDIBULAR REGION

107



* Boundaries:

- (1) Above : lower border of mandible.
- (2) below & in front : ant. belly of digastric.
- (3) below & behind : post. " " "

* Roof : Formed by :

- (1) the post. part of mylohyoid m. (anteriorly).
- (2) the post. part of hyoglossus m. (posteriorly).

* Floor :

- (1) skin.
- (2) Superficial fascia containing : platysma, ant. facial v. & cervical br. of facial n.
- (3) deep fascia.

* Contents :

- | | |
|---------|---|
| glands | (1) submandibular salivary gland: occupies the greater part of the triangle. |
| | (2) submandibular L.Ns: lying along the base of the mandible on the outer surface of the gland. |
| vessels | (3) part of the facial a. & its submental branch. |
| | (4) Common facial v. |
| nerves | (5) hypoglossal n. |
| | (6) lingual n. & submandibular ganglion |
| | (7) n. to mylohyoid: lying deep to the ant. belly of digastric |
- } lie on hyoglossus m. deep to the submand. gland.

* **Origin:** it has 2 bellies:

- (1) ant. belly: arises from the digastric fossa on the lower border of mandible close to Symphysis menti.
- (2) Post. belly: arises from the digastric notch on the med. surface of mastoid process.

* **Insertion:** into the intermediate tendon which is connected to the hyoid bone by a fibrous loop.

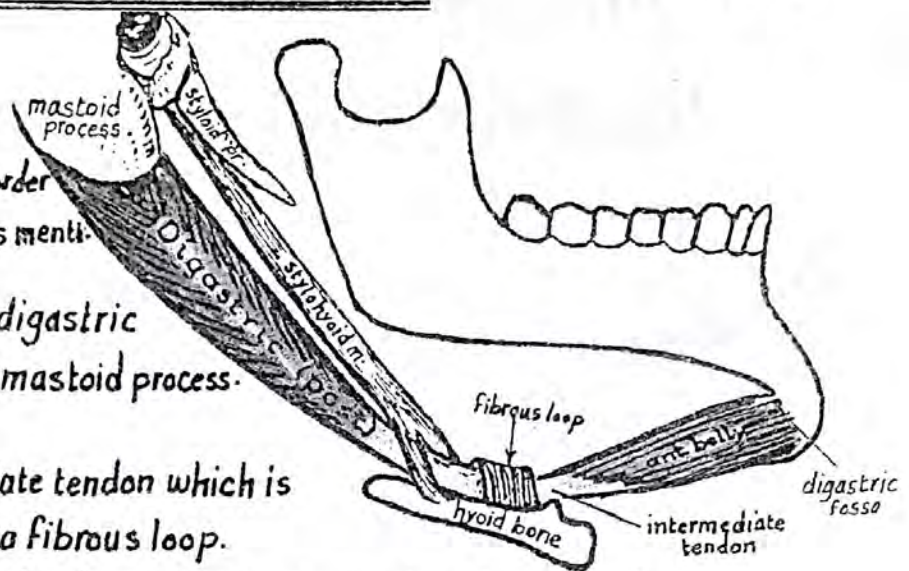
N.B: the intermediate tendon is also fixed in position by the insertion of stylohyoid m.

* **N. supply:**

- (1) Ant. belly: by n. to mylohyoid (from mandibular n.) as it develops from 1st pharyngeal arch.
- (2) post. belly: by facial n. as it develops from the 2nd pharyngeal arch.

* **Action:**

- (1) the ant. belly: depresses the chin (opening the mouth).
- (2) the post. belly: retracts the hyoid bone upwards & backwards.
- (3) both bellies: suspend the hyoid bone & fix it to allow better action of infrahyoid mm.



Relations

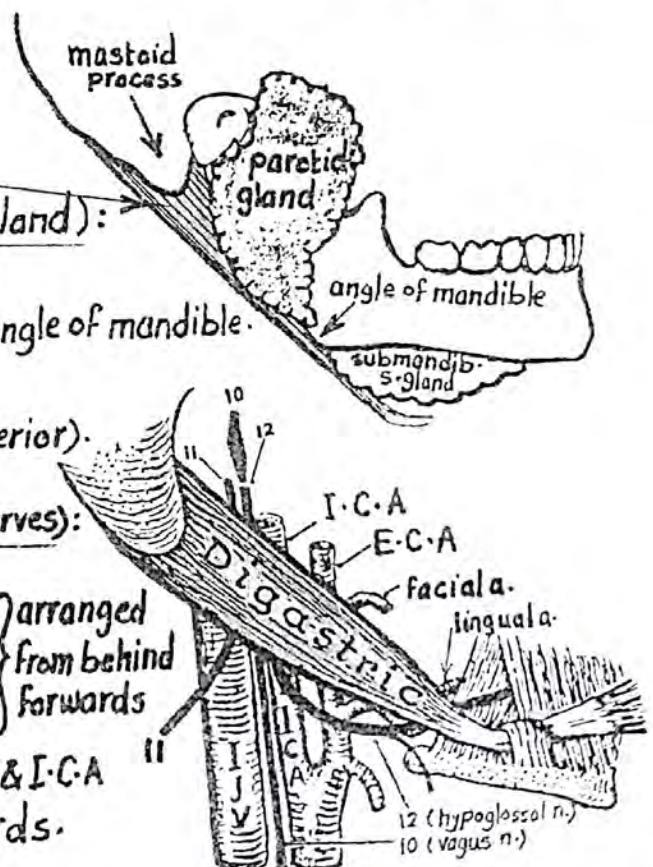
I- Post. belly:

(A) Superficial relations: (bone-gland-bone-gland):

- (1) mastoid process: most posterior
- (2) parotid gland: between mastoid pr. & angle of mandible.
- (3) angle of mandible.
- (4) submandibular salivary gland (most anterior).

(B) Deep relations: (3 big vessels & 3 cranial nerves):

- (1) the internal jugular vein (I. J. V.)
- (2) the internal Carotid artery (I. C. A.)
- (3) Ext. Carotid a. & its lingual & facial branches
- (4) Vagus n. (10) runs vertically between I. J. V & I. C. A.
- (5) accessory n. (11) runs downwards & backwards.



(6) hypoglossal n.: runs downwards & forwards between the muscle & the I.C.A **109**

(C) Its upper border: is related to stylohyoid m. & post. auricular a.

(D) Its lower border: is related to the occipital a.

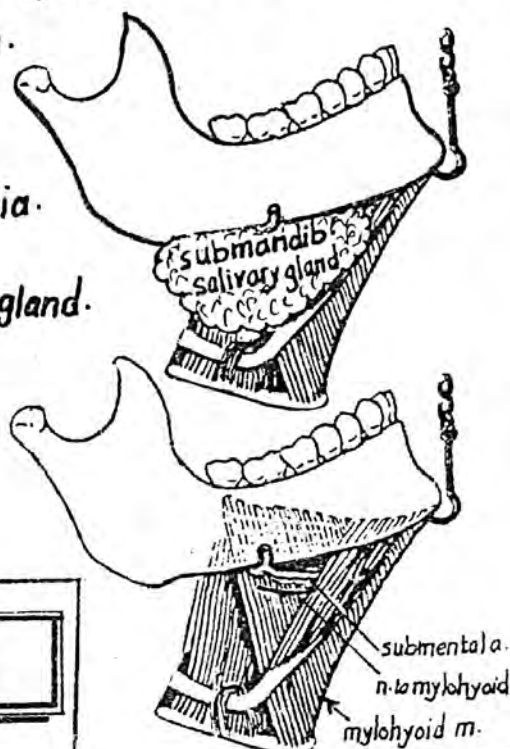
II- Ant. belly:

(A) superficial relations:

- (1) skin.
- (2) superficial fascia.
- (3) platysma.
- (4) submandibular gland.

(B) Deep relations: (1) mylohyoid m.

(2) n. to mylohyoid



MYLOHYOID MUSCLE

* it is a thin sheet of muscle which forms the floor of the ant. part of the mouth & is called the "Oral diaphragm"

* Origin: mylohyoid line of mandible.

* Insertion:

(1) the ant. fibres ($\frac{3}{4}$ of the muscle):

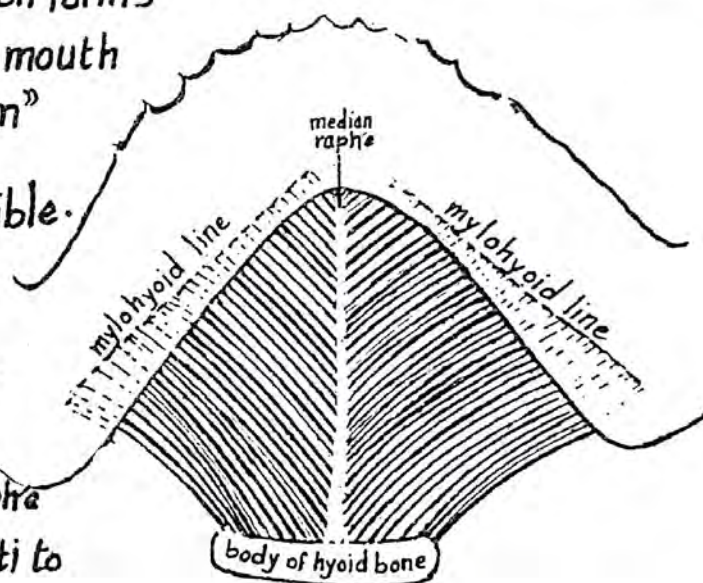
join their corresponding fibres of the opposite side in a median raphe extending from the symphysis menti to the body of hyoid bone.

(2) the post. fibres ($\frac{1}{4}$ of the muscle): are inserted into the body of hyoid.

* N. Supply: n. to mylohyoid, a branch of inf. alveolar n. (from mandibular n.).

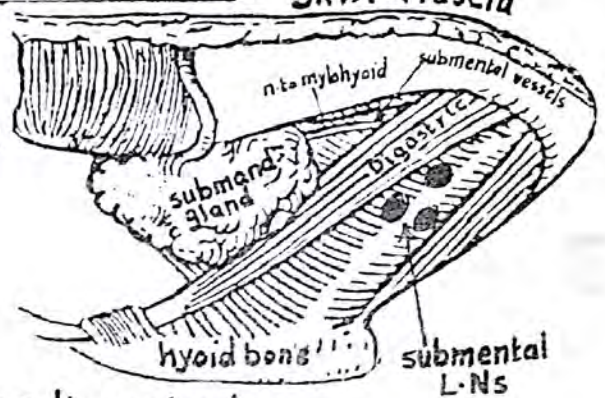
* Action (of both muscles):

- (1) they support the floor of the mouth
- (2) they elevate the floor of the mouth & hyoid bone during swallowing.
- (3) they can depress the mandible (open the mouth) if the hyoid bone is fixed.



(A) Superficial (lower) relations:

- (1) skin, superficial fascia (containing platysma) & deep fascia.
- (2) ant. belly of digastric m.
- (3) submental vessels & L.Ns.
- (4) mylohyoid vessels & nerve
- (5) the superficial part of the submandibular salivary gland.

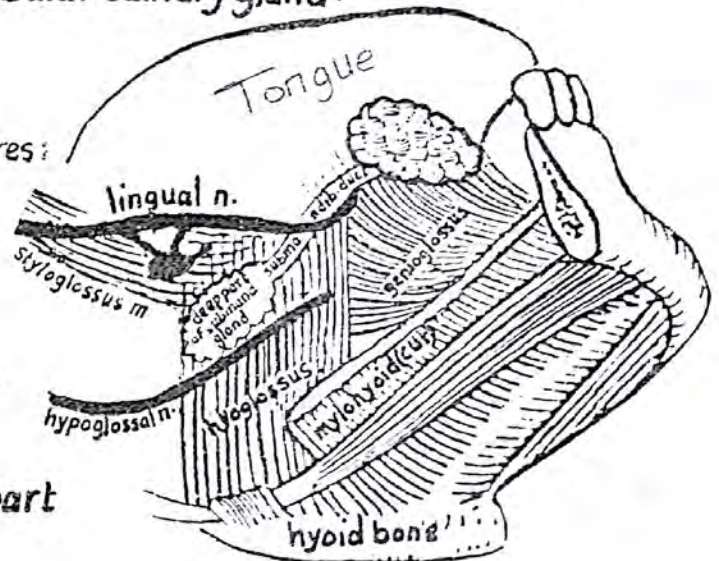


(B) Deep (upper) relations:

- (1) Hyoglossus m. with the following structures:

intervening between it & mylohyoid:

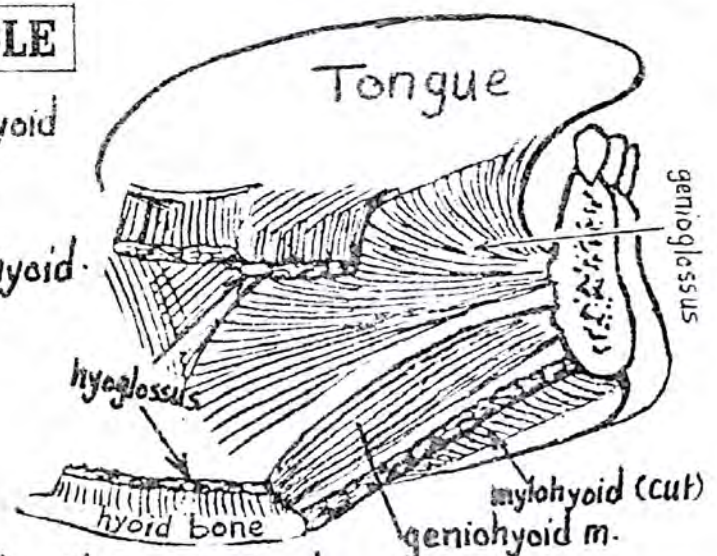
- (a) lingual n. & submandibular gang. (above).
 - (b) hypoglossal n. (below)
 - (c) deep part of submandibular gland & its duct (in the middle).
- (2) Styloglossus m.: post. to the upper part of hyoglossus.
 - (3) genioglossus & geniohyoid muscles: ant. to the hyoglossus m.
 - (4) Sublingual salivary gland on the lat. surface of genioglossus.



GENIOHYOID MUSCLE

- * it is a small m. lying deep to (above) mylohyoid
- * Origin: from the inf. genial tubercle
- * Insertion: upper surface of body of hyoid.
- * N. supply: from C1 via hypoglossal n.
- * Action:

- (1) elevates the hyoid bone
- (2) it can depress the mandible if the hyoid bone is fixed.



GENIOGLOSSUS MUSCLE

See the tongue (page 167)

HYOGLOSSUS MUSCLE

111

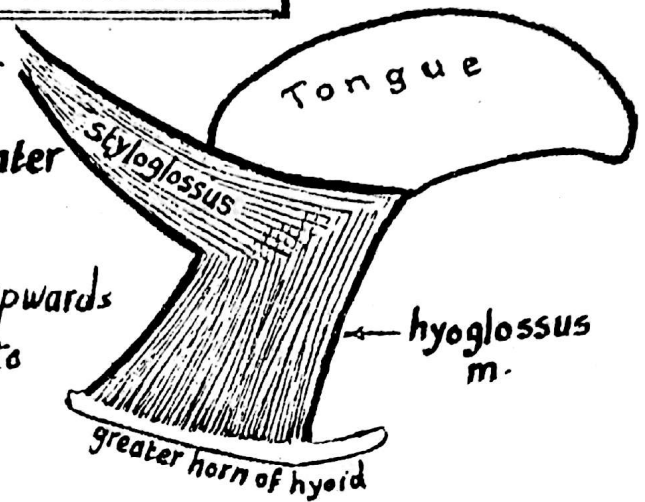
* It is a flat quadrangular fleshy m.

* **Origin**: from the whole length of greater horn of hyoid bone.

* **Insertion**: the fibres run vertically upwards deep to mylohyoid m. to be inserted into the post $\frac{1}{2}$ of side of tongue deep to styloglossus m.

* **N-supply**: hypoglossal n.

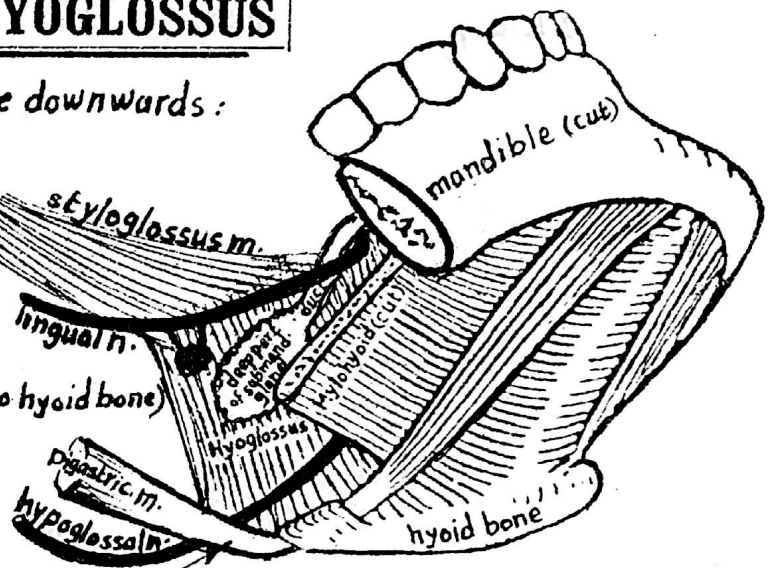
* **Action**: it draws the post. part of the tongue downwards thus helps sucking.



RELATIONS OF HYOGLOSSUS

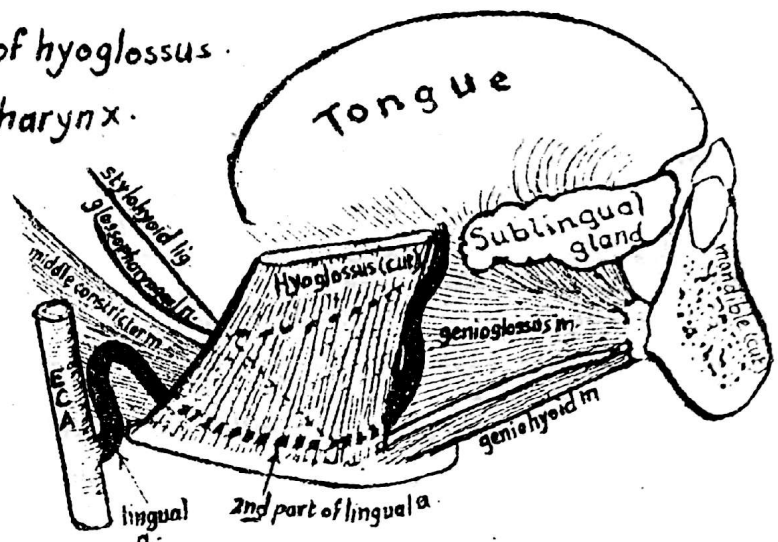
(A) **Superficial relations**: from above downwards:

- (1) Styloglossus m. (in the upper most part).
- (2) lingual n. & submandibular ganglion.
- (3) deep part of submandibular gland & submandibular duct.
- (4) hypoglossal n. & deep lingual V. (close to hyoid bone)
- (5) mylohyoid m.: covering the ant. part of the muscle but separated from it by the above-mentioned structures.
- (6) the post. part is related to intermediate tendon of digastric & submandibular gland.



(B) **Deep Relations**:

- (1) genioglossus: deep to the ant. part of hyoglossus.
- (2) origin of middle constrictor m. of pharynx.
- (3) stylohyoid lig.
- (4) glossopharyngeal n.
- (5) 2nd. part of lingual artery. close to the greater horn of hyoid.

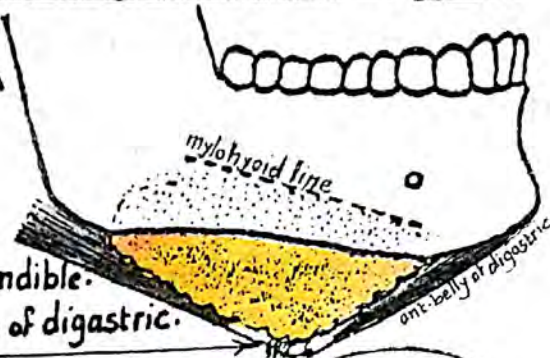


SUBMANDIBULAR SALIVARY GLAND

112

* **Site & extent** : it lies in the digastric Δ extending:

- anteriorly : to the mental foramen.
- posteriorly : to the angle of mandible.
- above : it reaches the mylohyoid line of mandible.
- below : it overlaps the intermediate tendon of digastric.



* **Size** : about $\frac{1}{2}$ the size of parotid gland.

* **Shape** : wedge shaped.



* **Structure** : it consists of a large superficial part & a small deep part.

The 2 parts are continuous together around the post. border of mylohyoid.

* **Surfaces & relations of the Superficial part.**

the superficial part has 3 surfaces : lateral, medial & inferolateral.



(A) the Inferolateral Surface : is related to:

- (1) skin
- (2) superficial fascia containing platysma.
- (3) ant. facial v.
- (4) Cervical br. of facial n.
- (5) submandibular lymph nodes.
- (6) facial a. grooving its post. part.

(B) the lateral surface : is related to:

- (1) the submandibular fossa of mandible & n. to mylohyoid (in its groove).
- (2) facial a. : descending between this surface & the mandible.
- (3) med. pterygoid m. at its insertion into the angle of mandible.

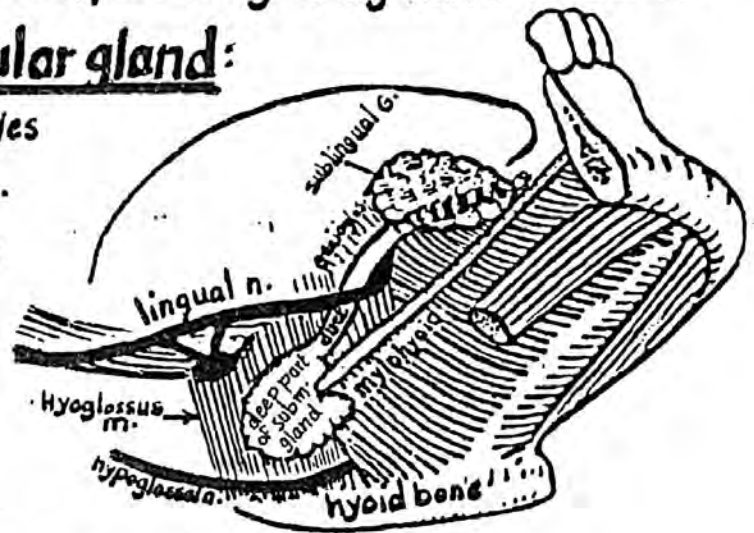
(C) the Medial surface :

- (1) its ant. part is related to mylohyoid m. with the n. to mylohyoid & submental a. on it.
- (2) its middle part is related to hypoglossus m. with the structures on its lat. surface :
 - (a) lingual n. with submandibular ganglion suspended from it.
 - (b) hypoglossal n.
 - (c) the deep part of the submandibular gland & its duct
 - (d) deep lingual vein

(3) its post. part is related to styloglossus m. & post. belly of digastric m. **113**

* The deep part of Submandibular gland:

- it is a thin tongue-like process which lies between mylohyoid & hyoglossus muscles.
- it is continuous with the superficial part at the post. border of mylohyoid.
- it is related to lingual n. above & hypoglossal n. below.



* The Submandibular duct:

- it is 5 cm. long & arises from the medial surface of the superficial part.
- it runs through the deep part of the gland then passes forwards between mylohyoid & hyoglossus muscles.
- finally it passes between genioglossus (medially) & sublingual gland (laterally).
- it ends by opening into the floor of mouth close to the frenulum of tongue.

N.B: the lingual n. has tripple relation with the submandibular duct :

(1) it descends lat. to the duct (2) then curves below the duct (3) then ascends med. to it.

* Arterial Supply : branches from facial & lingual arteries.

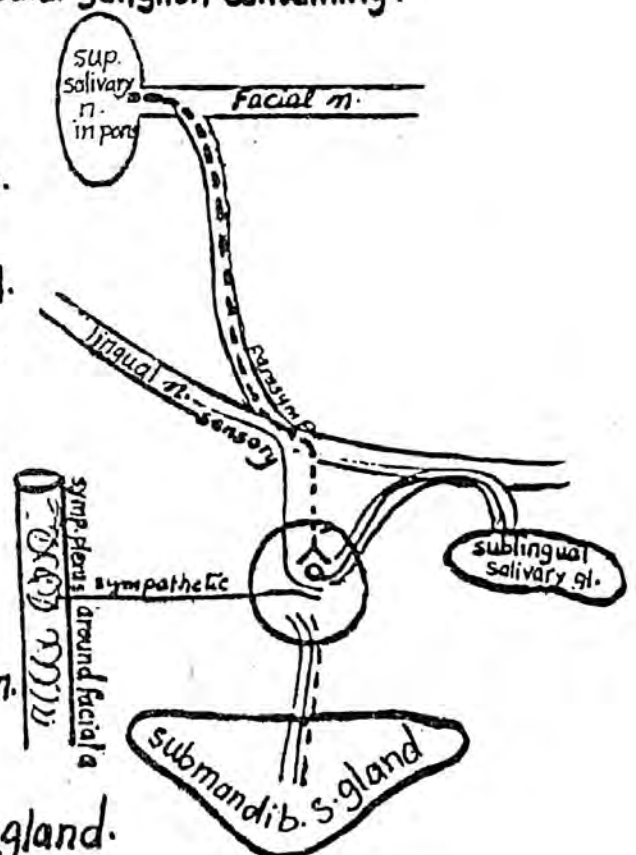
* Nerve supply : branches from the submandibular ganglion containing :

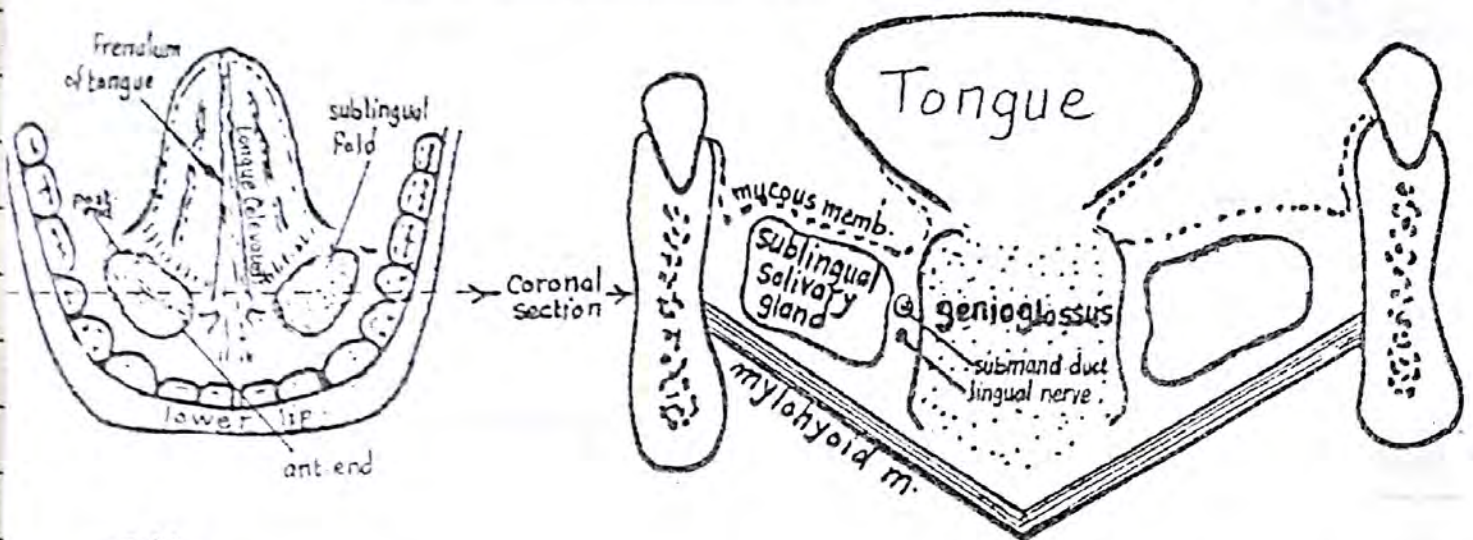
- (1) Sensory fibres : derived from the lingual n. & passing through the ganglion without relay.
- (2) Sympathetic fibres : derived from the symp. plexus around facial a. & passing through the ganglion without relay to reach the gland.
- (3) Parasympathetic fibres (secretomotor) :

(a) the preganglionic fibres arise from the sup. salivary nucleus in the pons → pass with facial n. then its Chorda tympani branch which joins the lingual n.

(b) The fibres relay in the submandibular ganglion.

(c) the postganglionic fibres pass directly from the ganglion to the submandibular gland.





* Site:

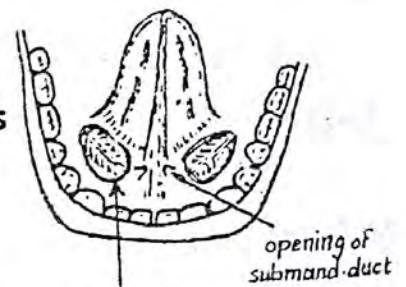
it lies under the mucous membrane of the mouth (beneath the tongue) forming the sublingual fold & occupying the sublingual fossa of the mandible.

* Size: it is the smallest of the 3 salivary glands.

* Shape: almond-shaped, its long axis is directed forwards & medially with wide ant. end & narrow post. end.

* Relations:

- (1) superiorly: mucous memb. of mouth (raised to form the sublingual fold).
- (2) inferiorly: mylohyoid m.
- (3) anterolaterally: sublingual fossa of mandible.
- (4) medially: genioglossus m. separated from the gland by the lingual n. & the submandibular duct.



* Ducts of the gland:

the gland gives about 10-20 ducts which may open either into the submandibular duct or open directly into the mucous memb. of floor of mouth along the sublingual fold.

* Arterial Supply: (1) sublingual br. of lingual a.
(2) submental br. of facial a.

* Nerve supply: branches from the lingual n. containing:

- (1) sensory fibres.
 - (2) sympathetic fibres
 - (3) parasympathetic "
- } derived from the submandibular ganglion.

MUSCULAR TRIANGLE

115

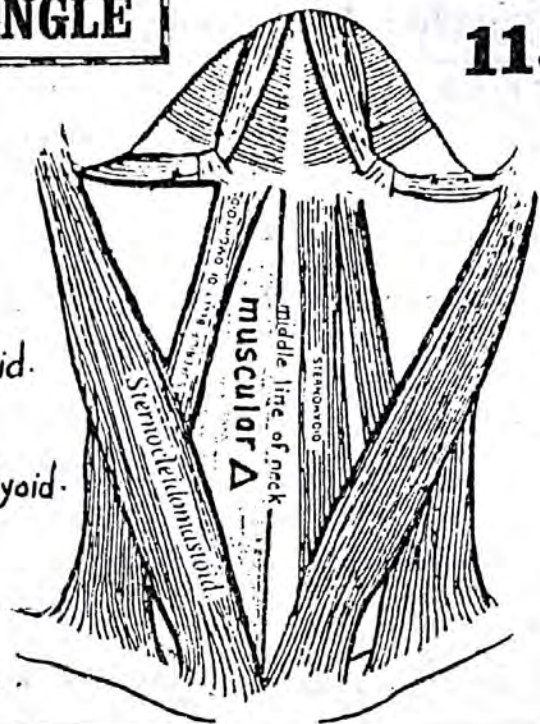
* So called because it contains muscles.

* Boundaries:

- in front: middle line of neck.
- behind & above: sup. belly of omohyoid.
- behind & below: ant. border of sternomastoid.

* Contents:

- (1) the infrahyoid muscles { (1) Sternohyoid
(2) sup. belly of omohyoid.
(3) sternothyroid
(4) thyrohyoid
- (2) the lat. lobe of thyroid gland lying deep to sternohyoid & sternothyroid muscles.



INFRAHYOID MUSCLES

- they are 4 muscles arranged in 2 layers:

- (a) superficial layer: sternohyoid & omohyoid.
- (b) deep layer: sternothyroid & thyrohyoid.

1- STERNO-HYOID MUSCLE

* Origin: back of manubrium & med. end of clavicle.

* insertion: lower border of body of hyoid alongside middle line.

* N. Supply: ansa cervicalis.

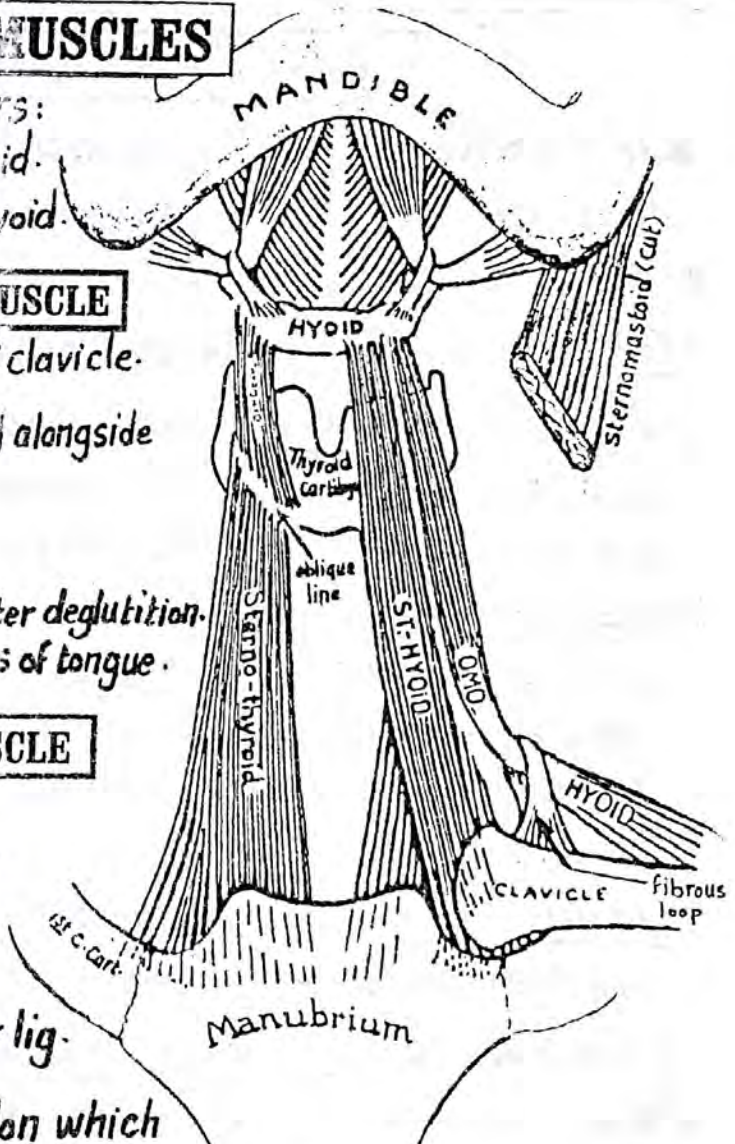
* Action: (1) depression of hyoid bone after deglutition.
(2) fixation of hyoid bone during movements of tongue.

2- OMOHYOID MUSCLE

* Origin: it has 2 bellies:

- (1) sup. belly: from lower border of body of hyoid lat. to sternohyoid.
- (2) inf. belly: arising from upper border of scapula & supra scapular lig.

* Insertion: by an intermediate tendon which lies on I.J.V. & held in position by a fascial sling connecting it to clavicle.
N.B Some of the fibres of the intermediate tendon are inserted into the deep fascia around the opening of Ext. jug. V. to keep it patent.



* N. Supply : Ansa cervicalis.

116

* Action : (1) like sternohyoid (2) pulls the deep fascia around Ext. jug. v.

3-STERNOHYOID MUSCLE

* Origin : From back of manubrium & the 1st Costal cartilage.

* Insertion : into oblique line of thyroid Cartilage.

* N. Supply : ansa cervicalis.

* Action : pulls the larynx down in the second phase of deglutition.

4-THYROHYOID MUSCLE

* Origin : Oblique line of thyroid cartilage.

* Insertion : lower border of the body & the greater horn of hyoid bone.

* N. supply : n. to thyrohyoid (br. from hypoglossal n. but its fibres are derived from C₁).

* Action : pulls the larynx upwards towards hyoid bone in the 1st phase of deglutition.

ANSA CERVICALIS (ansa = loop)

* It is a nerve loop formed by the union of 2 descending nerves & supplies 3 infrahyoid muscles.

* Site : it lies in front Carotid sheath.

* Formation : it is formed by the union of 2 descending nn.

(1) descendens hypoglossi (sup. limb of the ansa) :

its fibres arise from C₁, join the hypoglossal n. then leave it as it turns forwards across the Carotid sheath.

(2) descendens cervicalis (inf. limb of the ansa) :

its fibres arise from C_{2,3}. It begins behind the IJV then descends along its ant. surface to join the descendens hypoglossi in front of the Carotid sheath. Thus the ansa arises from C_{1,2,3}.

* Branches : arise from the convexity of the loop and supply the following muscles (near their lower ends) :

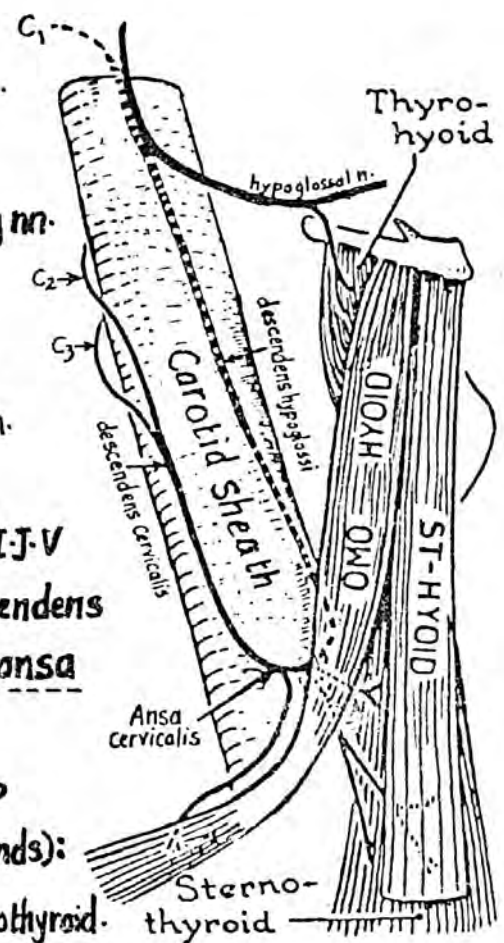
(1) the 2 bellies of omohyoid (2) sternohyoid (3) sternothyroid.

* N.B : there are 3 nerve loops in the body :

(1) ansa cervicalis

(2) ansa subclavia : see the symp. chain in the head & neck (page 149).

(3) ansa lenticularis : see neuroanatomy (subthalamus).



117

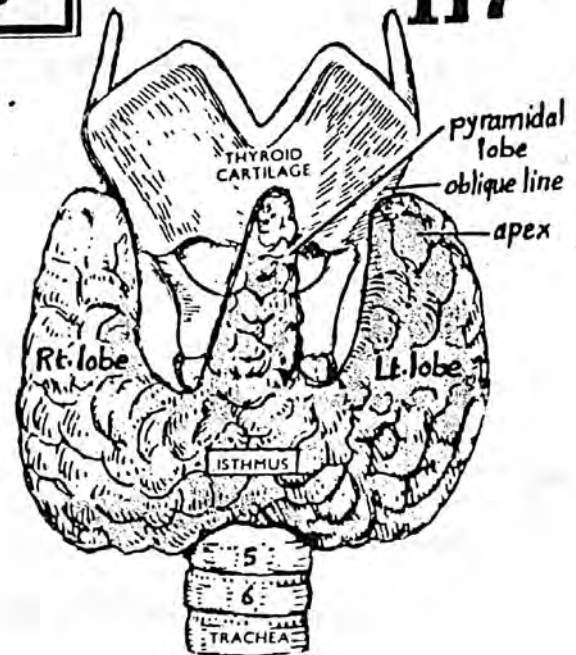
* **Size:** it is the largest endocrine gland in the body.

Its weight is about 25 grams.

* **Shape:** butter-fly

* **Structure:** it is formed of the following parts:

- **2 lat. lobes** : each lobe is pear-shaped (apex above)
- a narrow median **isthmus** connecting the 2 lat. lobes.
- a small **pyramidal lobe** may project upwards from the isthmus & may be connected to the hyoid bone by a fibromuscular band called **levator glandulae thyroideae** (remnant of thyroglossal duct in the embryo).



* **Site & extensions:** it lies on the front & sides of the lower part of neck.

- the **apex** of each lat. lobe rests on the thyroid cartilage reaching its oblique line.
- " **base** " " " " reaches the level of the 5th or 6th tracheal ring.
- the **isthmus** crosses the trachea opposite the rings 2, 3 & 4.

* **Capsules of the thyroid gland:** the gland has 2 Capsules:

- (1) **true Fibrous Capsule** enclosing the gland.
- (2) **false Fascial Capsule** derived from the pretracheal fascia (see page 99).

N.B (1) the big vessels of the gland run between the 2 Capsules.

(2) the fascial capsule is thickened laterally forming the lat. (suspensory) lig. of Berry which fixes the gland to the cricoid cartilage.

(3) the attachment of the fascial capsule to the larynx above is responsible for the movement of the gland with the larynx up & down during deglutition.

I- The Isthmus: has $\left\{ \begin{array}{l} 2 \text{ surfaces : ant. \& post} \\ 2 \text{ borders : upper \& lower} \end{array} \right.$

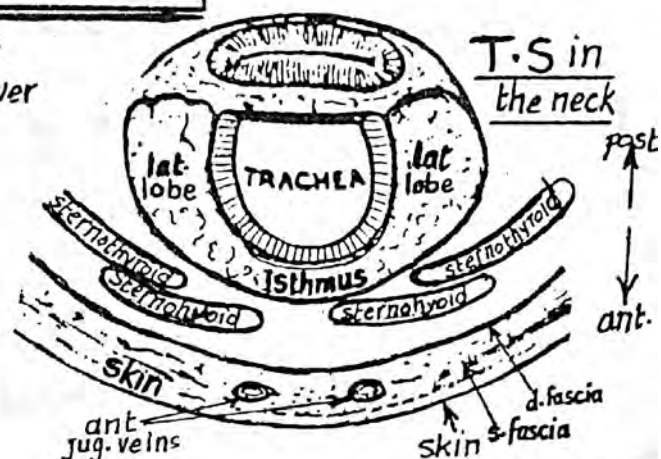
(1) **Ant. relations:** (1) skin & superficial fascia.

(2) ant. jugular veins.

(3) deep fascia.

(4) Sternohyoid & sternothyroid.

(2) **post. relations:** trachea (2nd, 3rd & 4th rings)

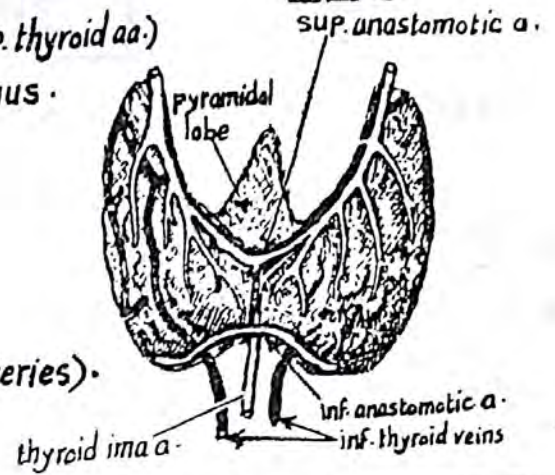


(3) the upper border of the isthmus:

- is related to sup. anastomotic a. (between Rt. & Lt. sup. thyroid aa.)
- the pyramidal lobe may project upwards from the isthmus.

(4) the lower border of the isthmus:

- gives rise to the Rt. & Lt. inf. thyroid veins.
- the thyroid ima a. enters the lower border.
- an inf. anastomotic a. (between Rt. & Lt. inf. thyroid arteries).
- runs along the lower border of the isthmus.

**II The lateral lobes:**

each lat. lobe has 3 surfaces:
 → anterolateral
 → medial
 → posterior

(A) Relations of the Post-Surface:

- (1) 2 parathyroid glands (sup. & inf.) embedded in the post. surface.
- (2) 2 arteries: (a) Common carotid a. (inside the Carotid sheath) & (b) inf. thyroid a. before it enters the gland. (c) longus coli muscle.

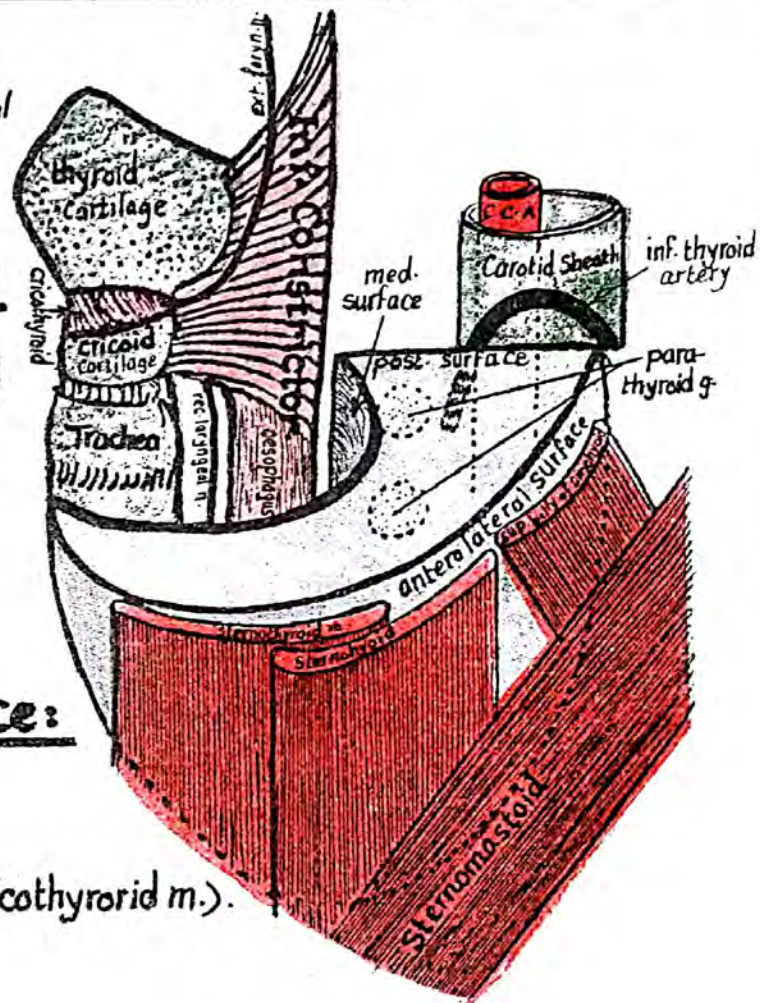
(B) Relations of the Med. Surface:

(it is related to tubes & nerves):

- (1) its upper part is related to
 - (a) larynx (thyroid & cricoid cartilages & cricothyroid m.).
 - (b) pharynx (inf. constrictor m.).
 - (c) external laryngeal n.
- (2) its lower part is related to:
 - (a) trachea
 - (b) oesophagus
 - (c) recurrent laryngeal n. in between.

(C) Relations of the anterolateral Surface: (skin, fascia & muscles)

- (1) Skin, superficial fascia (containing platysma) & deep fascia (pretracheal fascia).
- (2) its upper part is crossed by sup. belly of omohyoid.
- (3) its middle part is covered by sternohyoid (superficially) & sternothyroid (deeply).
- (4) its lower part is overlapped by the ant. border of sternomastoid.

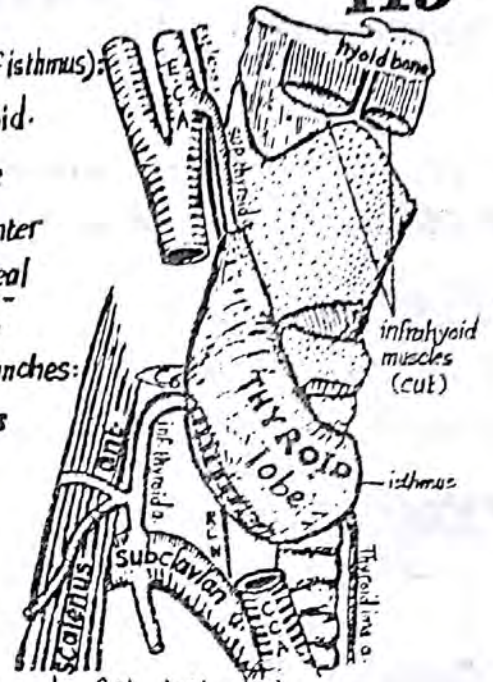


* ARTERIAL SUPPLY :

119

(1) Sup. thyroid a. (supplies the upper $\frac{1}{3}$ of the lat. lobe & upper $\frac{1}{2}$ of isthmus):

- origin : from the front of ext. carotid a. below greater horn of hyoid.
- Course & relations : it runs downwards & forwards deep to the infrahyoid muscles accompanied by the sup. thyroid V. to enter the apex of the lat. lobe. It is accompanied by the ext. laryngeal n. on the side of the pharynx but lies superficial to the nerve.
- termination : it ends in the apex by dividing into ant. & post. branches:
 - (a) the ant. br. : runs on the med. surface of the gland & anastomoses with its fellow of the opposite side.
 - (b) the post. br. : descends on the post. surface of the gland and anastomoses with the inf. thyroid a.
- Other branches in the neck : see page 132



(2) inf. thyroid a. (supplies the lower $\frac{2}{3}$ of the lat. lobe & the lower $\frac{1}{2}$ of the isthmus) :

- Origin : from thyro-cervical trunk (br. of 1st part of subclavian a.).
- Course & relations :
 - it runs upwards along the med. border of scalenus ant. till the level of C 6
 - then it curves medially deep to the carotid sheath & in front of vertebral a. to reach the post. surface of the gland. The recurrent laryngeal n. is related to the a. close to the gland.

(3) Thyroid ima a. (may be present or absent).

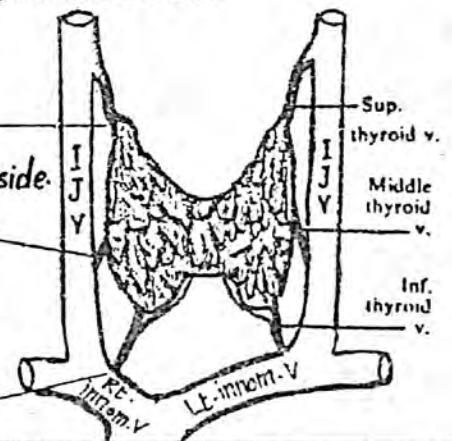
arises either from the arch of aorta or from the innominate a.

Course: it ascends upwards in front of the trachea to reach the isthmus of the gland.

N.B: the arteries of the thyroid are characterized by their rich anastomosis.

* VENOUS DRAINAGE :

- (1) Sup. thyroid V. : emerges from the apex of each lateral lobe (accompanying the sup thyroid a.) & ends in the I.J.V. of the same side.
- (2) middle thyroid v. : emerges from the lower part of each lat. lobe & crosses the C.C.A to open in the I.J.V. of the same side.
- (3) inf. thyroid vein : emerges from the isthmus & lower part of the lat. lobe to end in the innominate V. of the same side.



* LYMPHATIC DRAINAGE : the lymphatics of the gland drain into:

- (1) prelaryngeal L.Ns (in front of cricothyroid memb.)
- (2) pretracheal L.Ns (in front of trachea).
- (3) paratracheal L.Ns (alongside the trachea).
- (4) upper & lower deep cervical L.Ns (along the I.J.V.).
- (5) Brachiocephalic L.Ns (in the sup. mediastinum).

PARATHYROID GLANDS

see page 190

CAROTID TRIANGLE

120

* Boundaries:

- (1) behind : ant. border of sternomastoid m.
- (2) above : post. belly of digastric m.
- (3) below : sup. belly of omohyoid m.

* Floor:

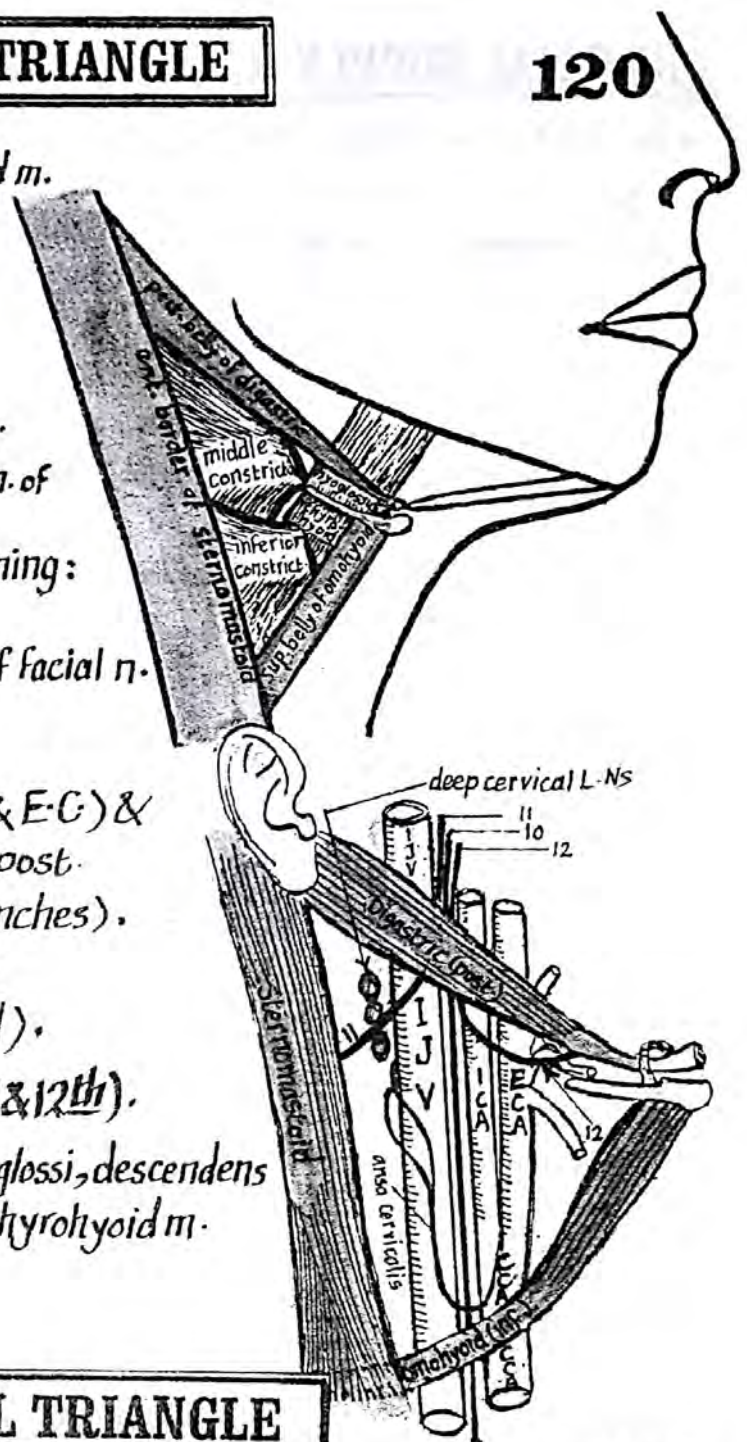
- (1) anteriorly: thyrohyoid & hyoglossus mm.
- (2) posteriorly: middle & inf. constrictor mm. of pharynx.

* Roof: skin & superficial fascia containing:

- (a) platysma, (b) common facial v.
- (c) tr. cutaneous n. of neck (d) cervical br. of facial n.

* Contents:

- (1) the **3 Carotid arteries** (C.C., I.C. & E.C.) & all branches of E.C.A except 3 (post. auricular a. & the 2 terminal branches).
- (2) **I.J.V & 3 of its tributaries**: (Common facial, lingual & sup. thyroid).
- (3) **last 3 cranial nerves** (10th, 11th & 12th).
- (4) **3 small nerves**: descendens hypoglossi, descendens cervicalis & n. to thyrohyoid m.
- (5) **Cervical sympathetic chain**.
- (6) **deep Cervical L.Ns.**



SUBMENTAL TRIANGLE

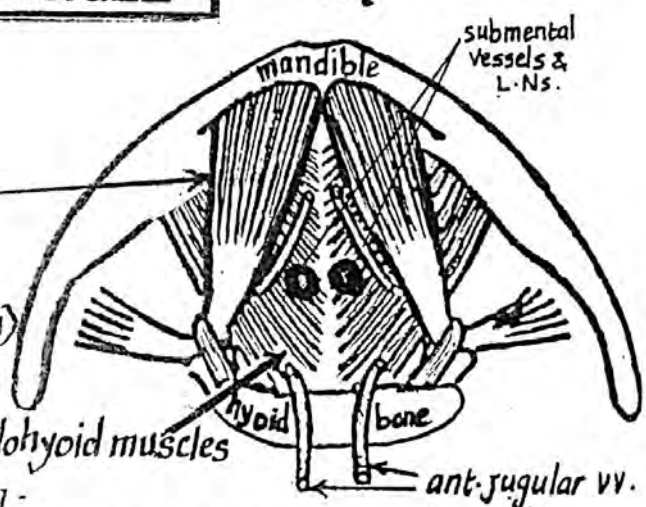
* Boundaries:

- (1) base: body of hyoid bone.
- (2) on each side: ant. belly of digastric m.
- (3) apex: symphysis menti.

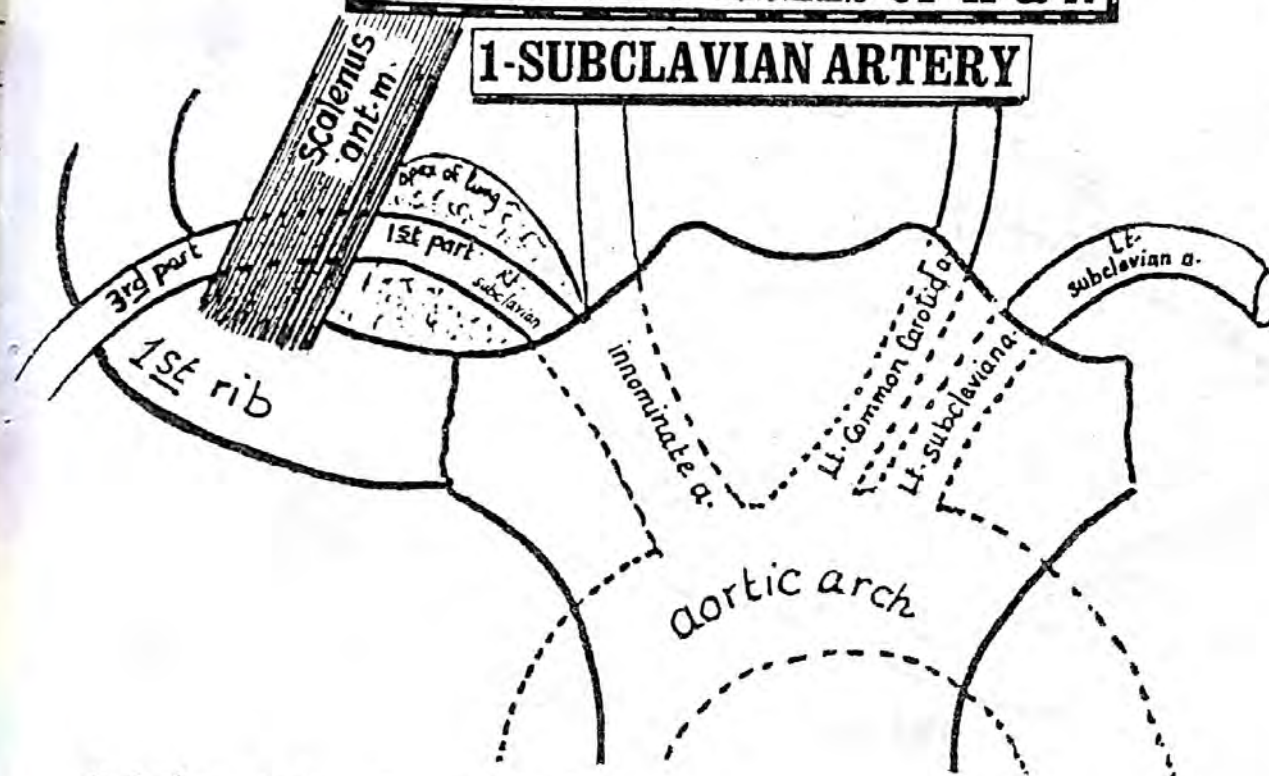
* Floor: skin, S. fascia (containing platysma) & deep fascia.

* Roof: formed by the lower surface of the 2 mylohyoid muscles & the median fibrous raphe inbetween.

* Contents: (1) submental L.Ns. (2) submental vessels (3) beginning of the ant. jugular vv.



1-SUBCLAVIAN ARTERY



* **Origin:** different on both sides:

- (1) Lt. subclavian a. : arises from the arch of aorta behind the centre of manubrium. It runs upwards & to the left to enter the neck behind the Lt. sternoclavicular joint.
- (2) Rt. subclavian a. : arises as one of the 2 terminal branches of the innominate a. behind the Rt. sternoclavicular joint.

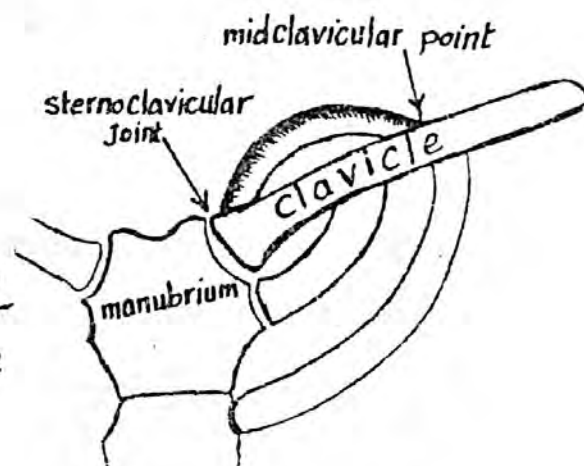
* **Termination:** Each subclavian a. ends at the outer border of the 1st rib by becoming the axillary a.

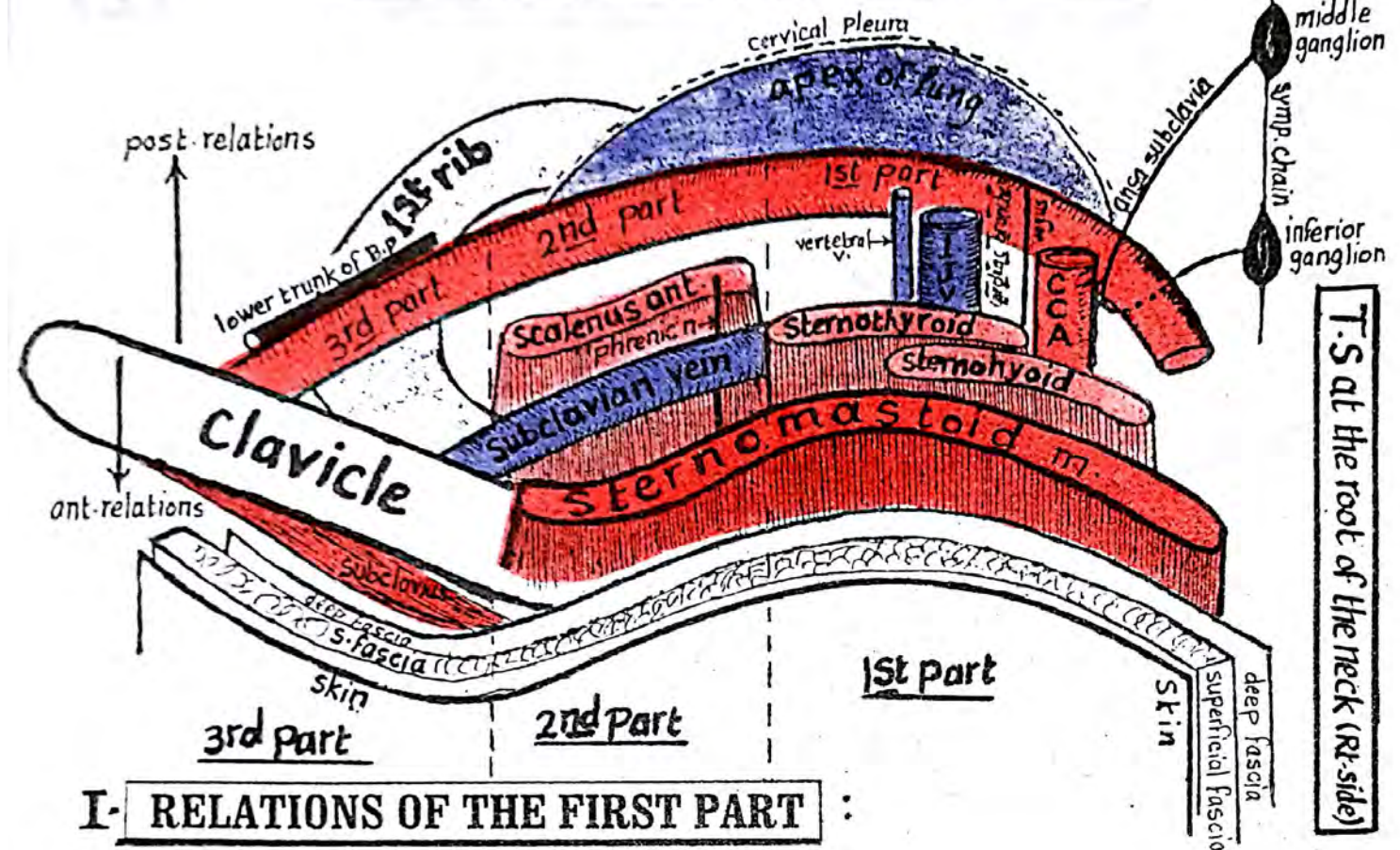
* **Course:** the artery has an arched course across the root of the neck in front of the lung shortly below its apex. The scalenus ant. m. descends in front of the artery dividing its course into 3 parts:

- 1st part : med. to scalenus ant.
- 2nd part : behind scalenus ant.
- 3rd part : lat. to scalenus ant.

* **Surface anatomy:**

draw a line slightly convex upwards beginning from the sternoclavicular joint & ending at the mid-clavicular point. The most convex point of this line lies one finger above the clavicle.





I- RELATIONS OF THE FIRST PART :

(A) Anterior relations :

- (1) **3 superficial structures** : Skin , superficial fascia & deep fascia .
 - (2) **3 muscles** : (a) Sternomastoid, (b) Sternohyoid (c) Sternothyroid .
 - (3) **3 nerves** : (a) vagus (b) Cardiac branches of vagus & symp. chain (c) ansa subclavia
 - (4) **3 vessels** : (a) Common Carotid a. (b) I. J. V. (c) vertebral vein .
- N.B 3 other structures are related to the 1st part of the Lt. subclavian a. :
- (a) Lt. phrenic n. (b) Lt. innominate v. (c) thoracic duct.

(B) Posterior relations :

- (1) apex of the lung (2) cervical pleura (3) supra pleural membrane .

II- RELATIONS OF THE SECOND PART :

(A) Anterior relations :

- (1) **Skin**, superficial fascia & deep fascia .
- (2) **Sternomastoid**
- (3) **Subclavian v.** (separated from the artery by scalenus ant. m.) .
- (4) **Scalenus ant. & Rt. phrenic n.** on it (N.B : the Lt. phrenic n. is ant. to 1st part)

(B) Posterior relations : the same as the 1st part :

- (1) apex of the lung (2) Cervical pleura (3) supra pleural membrane .

III- RELATIONS OF THE THIRD PART

123

(A) Anterior relations:

- (1) skin, superficial fascia (containing platysma & supraclavicular nerves) & deep fascia
- (2) Clavicle, subclavius m. & subclavian v. (antero-inferior to the artery).

(B) Posterior relations:

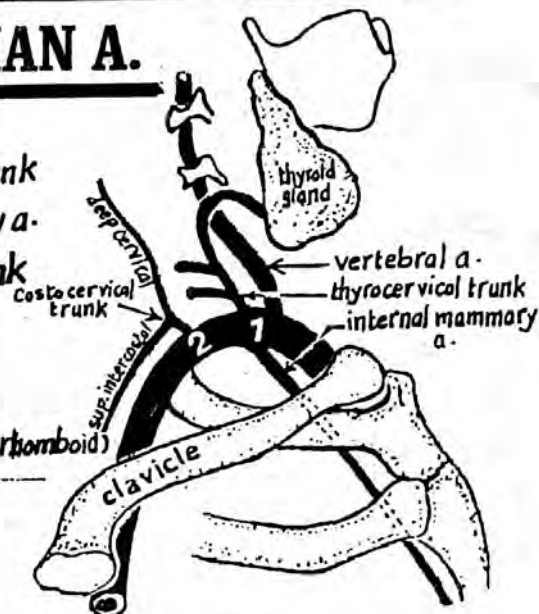
First rib & the lower trunk of the brachial plexus

BRANCHES OF SUBCLAVIAN A.

I- 1st part: gives 3 branches {
 (1) vertebral a.
 (2) thyrocervical trunk
 (3) internal mammary a.

II- 2nd part: gives one branch: Costo-cervical trunk

III 3rd part: No branches, but occasionally it gives the dorsal scapular a. (accompanying n. to rhomboid)



1- VERTEBRAL ARTERY

* **Origin:** arises from the 1st part of subclavian a.

* **Course & relations:** its Course is divided into 4 parts:

(1) **1st part:** from its origin to the tr. process of C6.

- it ascends in the vertebral Δ between longus Colli m. medially & scalenus ant. m. laterally.

- **ant. relations:** (1) C.C.A. (2) inf. thyroid a. as it crosses

at C6- (3) thoracic duct as it crosses laterally at the level of C7 (on the Lt. side) (4) Vertebral v.

- **post. relations:** (1) inf. Cervical symp. ganglion.

(2) 7th cervical tr. process (3) 7th & 8th cervical nerves.

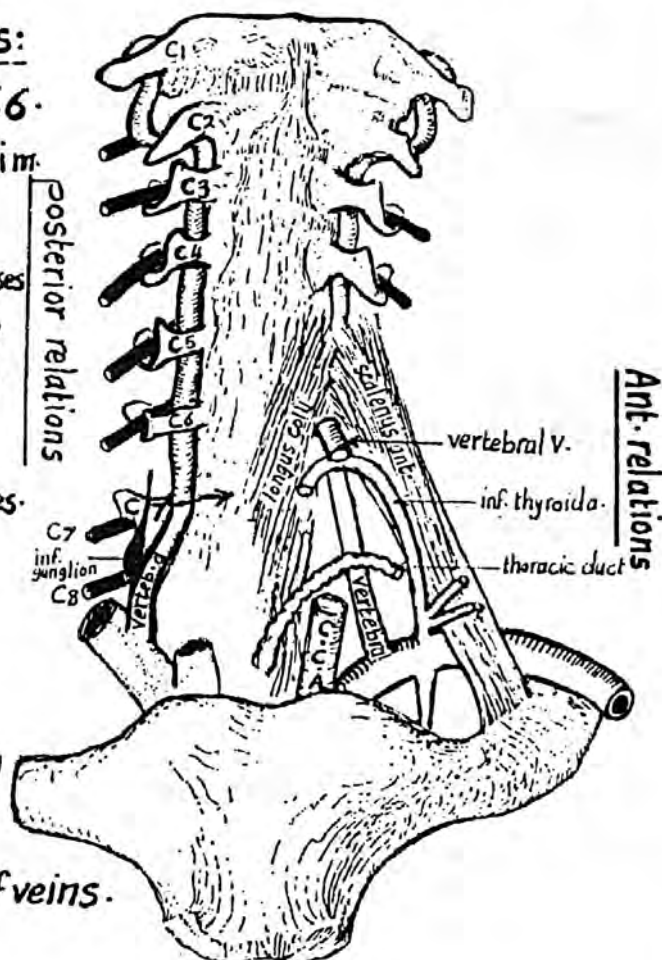
(2) **2nd Part:** ascends in the foramina

transversaria of the upper 6 Cervical vertebrae.

- **relations:**

(1) it ascends in front of the ant. rami of cervical nerves 2 $\rightarrow$ 6

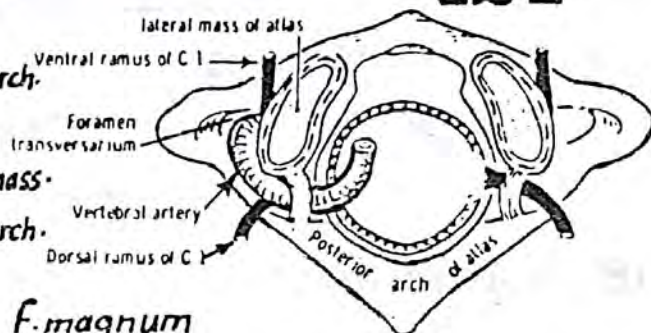
(2) it is surrounded by a symp. plexus & plexus of veins.



(3) **3rd Part** : lies in the suboccipital Δ :

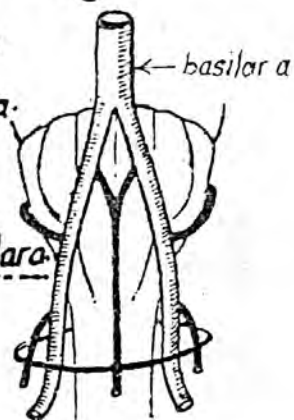
- it curves backwards behind the lat. mass of atlas grooving the upper surface of its post. arch.
relations :

- (1) the ant. 1st rami of C₁ lies between the a. & the lat. mass.
- (2) the post. 1st " " " runs between the a. & the post. arch.



(4) **4th part** : enters the cranial cavity through f. magnum

relations : it ascends on the side of medulla in front of the roots of hypoglossal n. then it inclines medially ascending in front of medulla.



* **Termination** : the vertebral a. ends at the lower border of pons by joining its fellow of the opposite side to form basilar a.

* **Branches of Vertebral a. :**

(A) Branches in the neck :

- (1) spinal branches which enter the intervertebral foramina to supply spinal cord.
- (2) muscular " : supplying the deep muscles of the neck.

(B) Branches in the cranial cavity :

- (1) ant. & post. spinal arteries
 - (2) medullary branches
 - (3) post. inf. Cerebellar artery
- } for details see neuroanatomy.

2-INTERNAL MAMMARY (THORACIC) ARTERY :

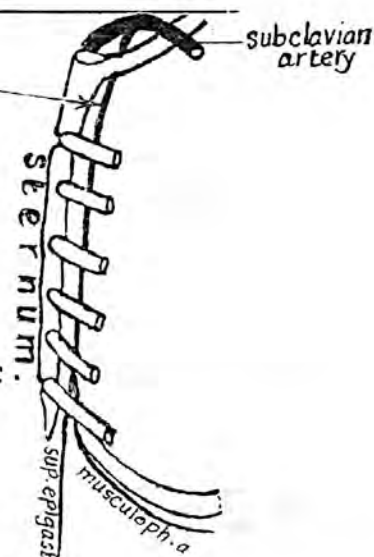
- Origin : from the lower surface of 1st part of subclavian a.

- Course & relations : it descends into the thorax running behind the upper 6 costal cartilages $\frac{1}{2}$ an inch lat. to the sternum.

- Termination : it ends opposite the 6th intercostal space by dividing into 2 terminal branches : musculophrenic & sup. epigastric.

- branches :

- (1) Pericardio-phrenic a. : accompanies the phrenic n.
 - (2) pair of ant. intercostal arteries in each of the upper 6 intercostal spaces
 - (3) perforating arteries which pierce the intercostal spaces to supply skin & breast.
 - (4) sup. epigastric (enters the rectus sheath)
 - (5) musculophrenic (runs along the costal margin)
- } the 2 terminal branches.



3-THYROCERVICAL TRUNK

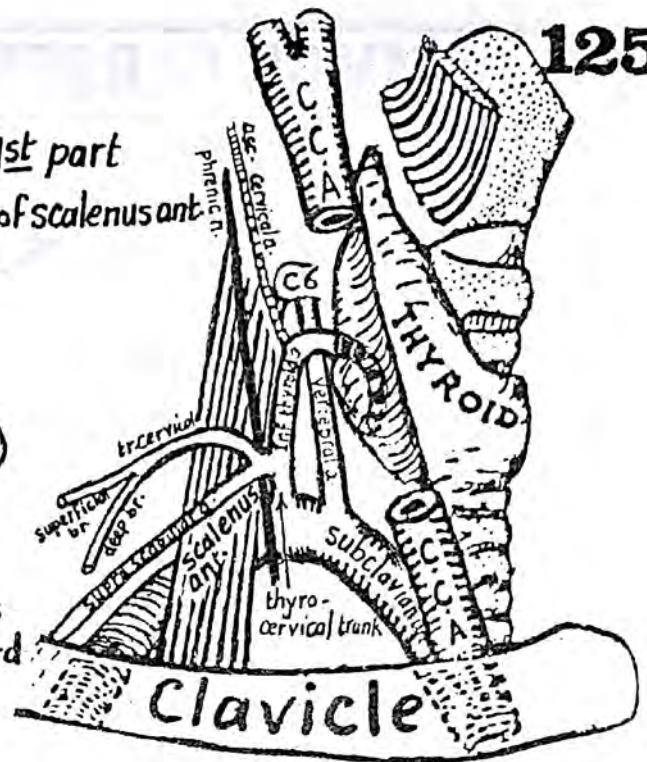
125

- it is a very short trunk arising from the 1st part of subclavian a. close to the med. border of scalenus ant.
- it divides immediately into 3 branches:

(a) Inf. thyroid a. :

- Course : See thyroid gland (page 119)
- branches :

- (1) ascending cervical a. ascends in front of tr. processes of cervical vertebrae. It supplies the surrounding mm. & gives brs. to the spinal cord.
- (2) muscular branches : to the infrahyoid mm., scalenus ant. & longus colli mm.
- (3) inf. laryngeal a. : accompanies recurrent laryn. n. to supply the larynx.
- (4) pharyngeal branches to supply the pharynx.
- (5) oesophageal & tracheal branches.
- (6) terminal glandular branches to the thyroid gland.



(b) Suprascapular a. :

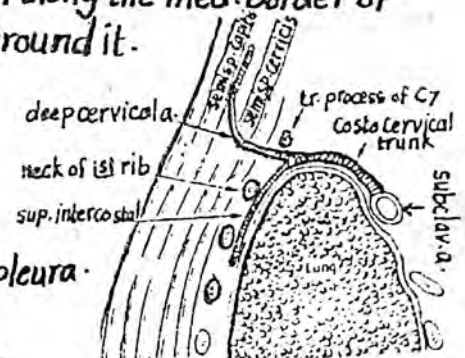
- runs laterally between sternomastoid & scalenus ant. to reach the post. Δ of neck.
- it passes downwards behind the clavicle accompanied by the suprascapular n.
- it shares in the anastomosis around the scapula.

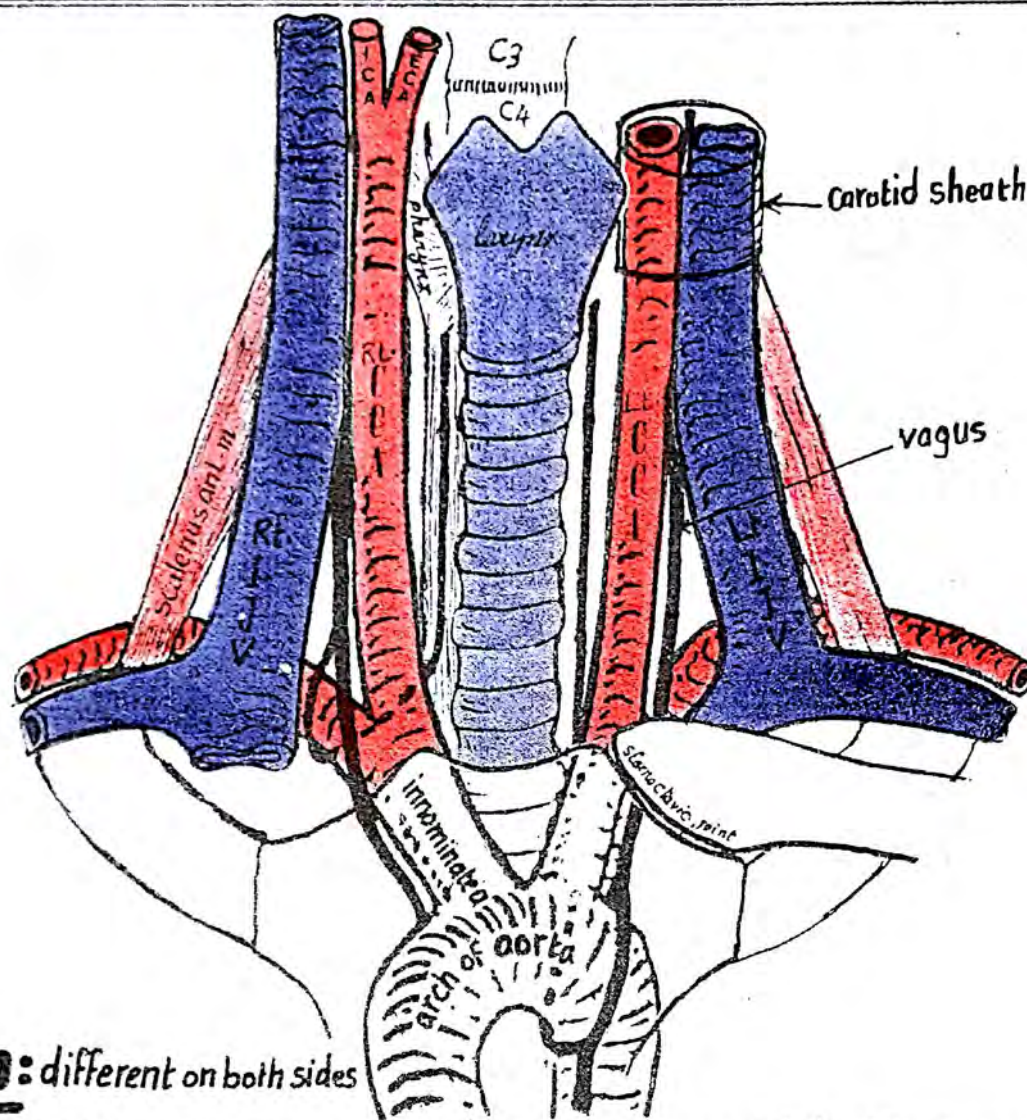
(c) transverse cervical a. :

- runs laterally between sternomastoid & scalenus ant. above the suprascapular a.
- it divides at the ant. border of levator scapulae into 2 branches : superficial & deep.
- (a) the superficial br. : ramifies on the deep surface of trapezius supplying it.
- (b) the deep br. : descends deep to levator scapulae then along the med. border of scapulae to share in the anastomosis around it.

(4) COSTO-CERVICAL TRUNK :

- arises from the 2nd part of subclavian a.
- it arches backwards above the apex of lung & cervical pleura.
- it ends in front of neck of 1st rib by dividing into :
- (a) sup. intercostal a. : which divides into the 1st & 2nd post. intercostal arteries.
- (b) deep cervical a. : ascends in the neck between semispinalis Capitis & Cervicis mm. to reach the suboccipital Δ where it anastomoses with descending br. of occipital a.





* **Origin:** different on both sides

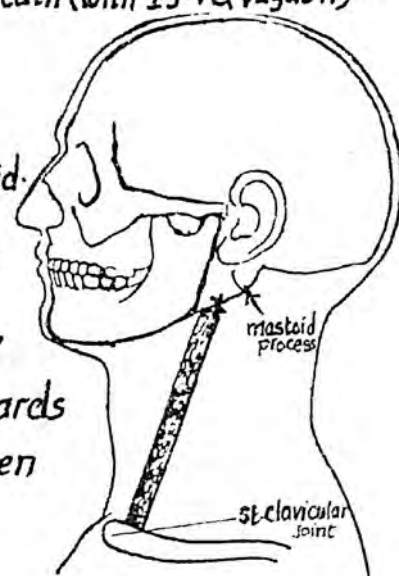
- (1) the Lt. C.C.A: arises from aortic arch & enters the neck behind Lt. sternoclavicular joint.
- (2) the Rt. C.C.A: arises as one of the 2 terminal branches of innominate a. & enters the neck behind the Rt. sternoclavicular joint.

* **Course:**

- it runs upwards & backwards in the neck inside the Carotid sheath (with I.J.V & vagus n.).
- it lies alongside the trachea & oesophagus (in the lower part) & larynx, pharynx (in the upper part).
- throughout its course, it is overlapped by ant. border of sternomastoid.

* **Termination:** it ends at the upper border of thyroid Cartilage (disc between C₃, C₄) by dividing into I.C.A & E.C.A.

* **Surface anatomy:** a line drawn upwards & backwards from the sternoclavicular joint to the point midway between the tip of the mastoid process & the angle of mandible.



RELATIONS OF C.C.A

127

(A) Ant. (Superficial) relations :

(1) the **3** "superficial layers": skin, superficial fascia & deep fascia.

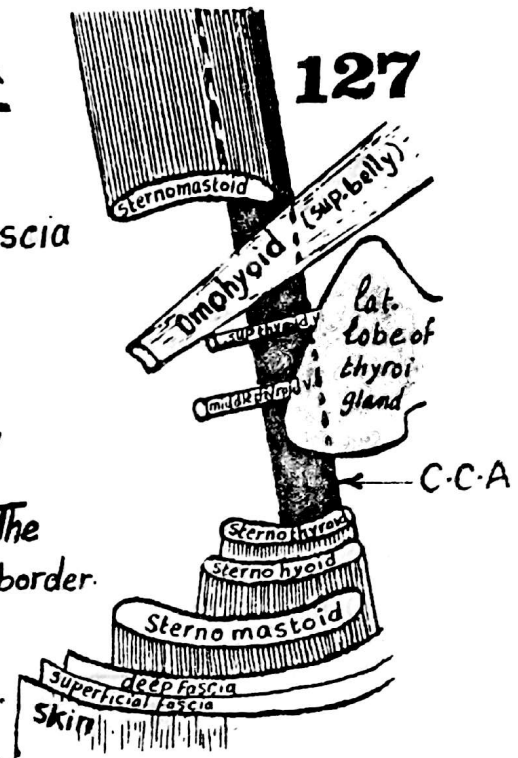
(2) the **3** "Sterno" muscles:

- (a) Sternohyoid } Cover the lower part of the artery
- (b) Sternothyroid }
- (c) Sternomastoid : Cover the artery in the lower part. The upper part of the a. is overlapped by its ant. border.

(3) **3** "thyroid" structures :

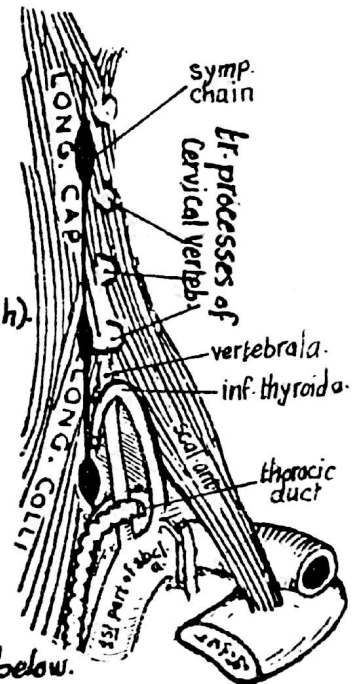
- (a) the lat. lobe of the thyroid gland (its post. surface).
- (b) middle thyroid v. }
- (c) superior » » } Cross the artery as they pass laterally to open into the I.J.V.

(4) the sup. belly of omohyoid & the loop of ansa cervicalis.



(B) Posterior (deep) relations :

- (1) transverse process of cervical vertebrae (lower 4).
- (2) prevertebral muscles : longus colli & longus capitis.
- (3) Sympathetic chain (embedded in the post. wall of Carotid sheath).
- (4) Vertebral a. (in the lower part of neck).
- (5) inf. thyroid a. (as it curves medially at the level of C6).
- (6) thoracic duct (on the left side only) as it curves laterally at the level of C7.



(C) Medial relations :

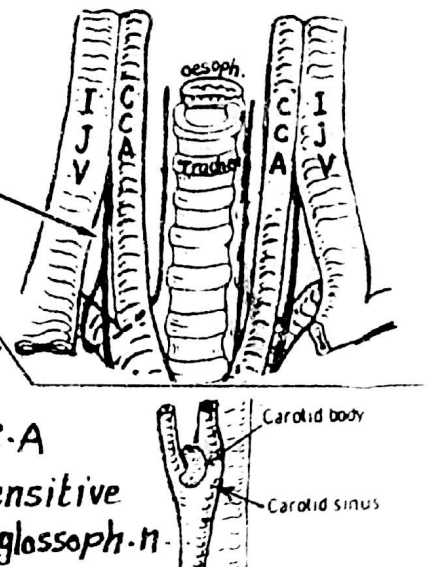
- (1) Trachea & oesophagus (with recurrent laryngeal n. in between) below.
- (2) Larynx & pharynx : above.

(D) Lateral relations :

- (1) the I.J.V (2) the vagus n. (posterolateral)

N.B: (1) Carotid body : is an oval cellular structure (less than $\frac{1}{2}$ cm) on the post. aspect of bifurcation of It contains chemoreceptors (sensitive for changes in the P.H). It receives sensory branch from the glossopharyngeal n.

(2) Carotid sinus : is a dilatation in the upper end of C.C.A and the beginning of I.C.A. It contains baroreceptor sensitive to changes in the arterial B.I. pressure. It is supplied by glossoph. n.



3-INTERNAL CAROTID ARTERY(I.C.A) 128

* **Beginning**: it arises as one of the 2 terminal branches of C.C.A at the level of upper border of thyroid Cartilage (disc between C₃ & C₄).

* **Termination**: in the Cranial Cavity, lat. to the optic chiasma by dividing into ant. cerebral & middle cerebral arteries.

* **Course**: its Course is divided into 4 parts :

- (1) Cervical part: ascending inside the Carotid sheath in the neck.
- (2) Intrapetrous part: in the Carotid Canal inside petrous part of temporal bone.
- (3) Intra Cavernous part: inside the Cavernous sinus.
- (4) Intra Cranial part: the terminal part of the artery inside the Cranial Cavity.

(A) CERVICAL PART OF I.C.A

* **Course**: it ascends vertically upwards (in line with C.C.A), inside the Carotid sheath to reach the Carotid Canal at the base of skull. At its origin it lies superficial in the Carotid Δ . Higher up it becomes more deep.

* **Relations**:

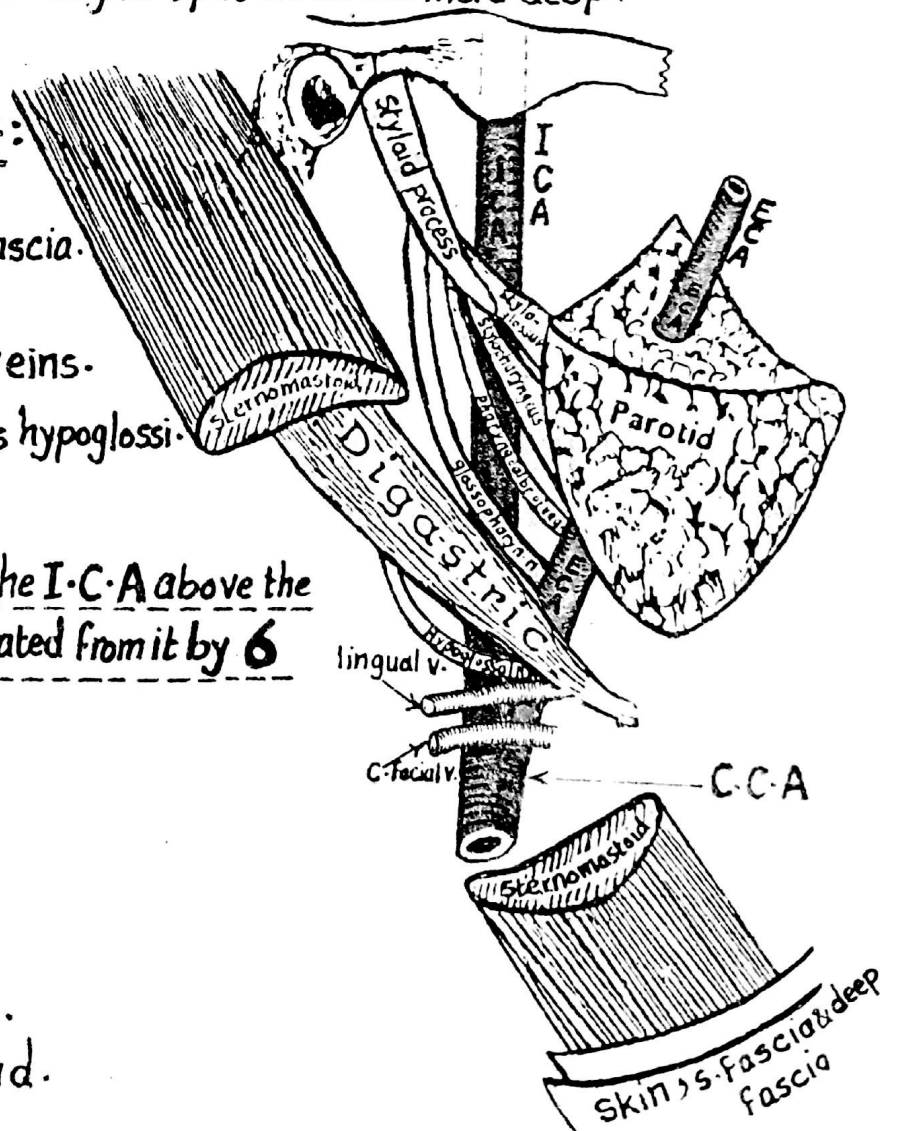
(A) Anterolateral (superficial) r.:

- (1) Skin, superficial fascia & deep fascia.
- (2) Sternomastoid m.
- (3) lingual v. & Common facial veins.
- (4) hypoglossal n. & descendens hypoglossi.
- (5) post. belly of digastric m.

(6) **E.C.A** lies superficial to the **I.C.A** above the level of digastric m. but separated from it by 6

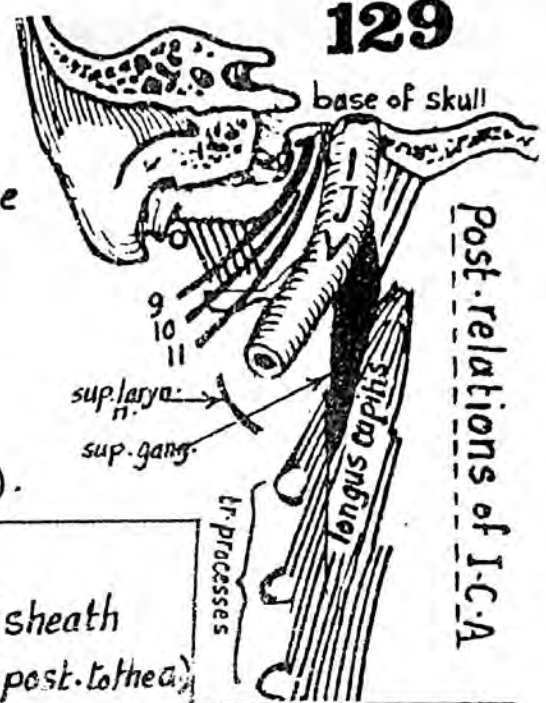
structures:

- (1) styloid process.
- (2) stylo glossus m.
- (3) stylo pharyngeus m.
- (4) glossopharyngeal n.
- (5) pharyngeal br. of vagus n.
- (6) a part of the parotid gland.



(B) Posterior relations:

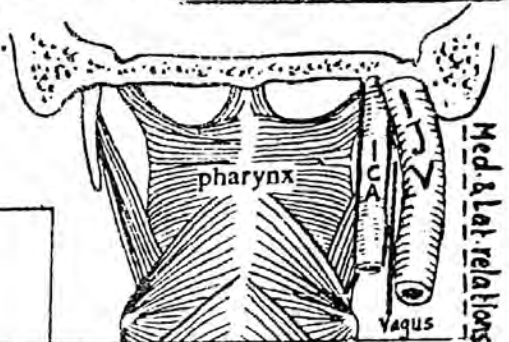
- (1) longus capitis m. separating the artery from the upper 3 cervical transverse processes.
- (2) Sup. Cervical sympathetic ganglion.
- (3) Sup. laryngeal n. (br. of vagus).
- (4) the I.J.V & the Cranial nerves 9, 10, 11 lie post. to the upper part of the a. (at the base of the skull).



(C) Lateral relations:

- (1) the I.J.V. lies lat. to the I.C.A. in the carotid sheath (except at the base of skull where it becomes post. to the a.)
- (2) the vagus n. lies posterolateral to the artery.

(D) Medial relations: wall of the pharynx.

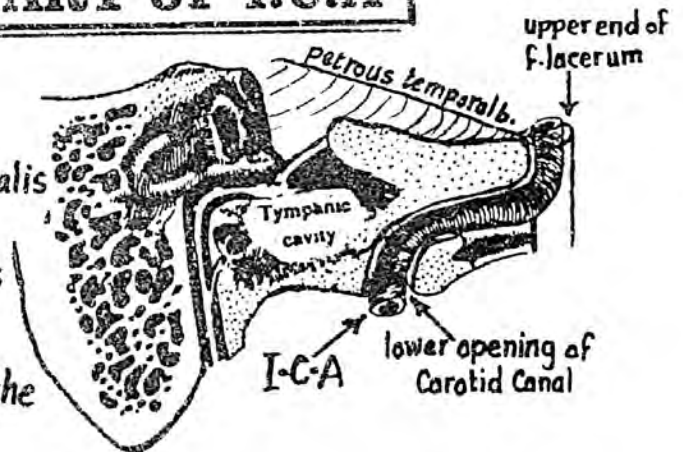


* Branches: No branches in the neck.

B- INTRAPETROUS PART OF I.C.A.

* Course:

- the I.C.A. enters the lower opening of the Carotid canal (in the middle part of normal basalis externa).
- it runs in the Carotid Canal first upwards then forwards and medially
- Finally it reaches the Cranial Cavity via the upper end of f. lacerum.



* Relations:

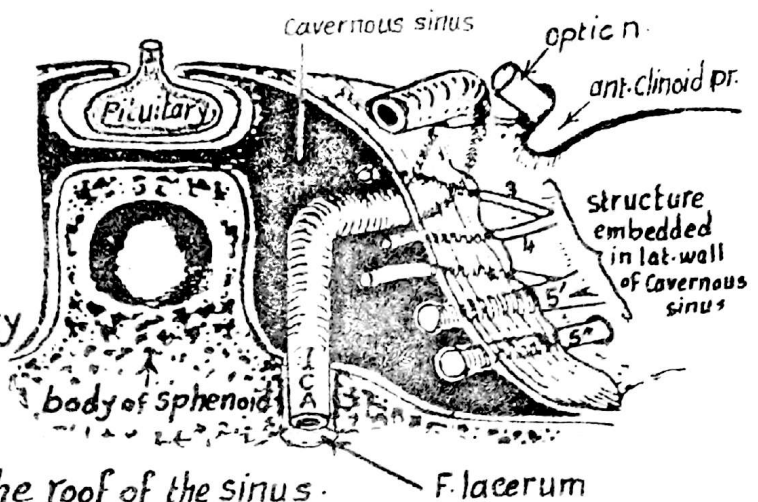
- (1) the I.C.A. lies in front of the middle & internal ear cavities.
- (2) it is surrounded by 2 plexuses: (a) venous plexus
(b) plexus of symp. fibres derived from the int. carotid n. (br. of sup. cervical symp. gang.)

* Branches:

- (1) 1-2 Carotico tympanic arteries to the middle ear cavity.
- (2) a small br. to the pterygoid canal.

* Course:

- at the upper end of the f. lacerum, the I.C.A pierces the post. wall of the Cavernous sinus.
- then it runs forwards inside the cavity of the sinus grooving the side of the body of sphenoid.
- finally it curves upwards to pierce the roof of the sinus.



* Relations:

- medially: body of sphenoid (containing sph. air sinus) & pituitary gland.
- laterally: - abducent n. (inside the cavity of the sinus).
- oculomotor, trochlear, ophthalmic & maxillary nn. (embedded in the lat. wall).
- anterosuperiorly: Optic n.

- * Branches: (1) sup. & inf. hypophyseal arteries to pituitary gland.
(2) meningeal branches to the meninges of ant. cranial fossa.

D- INTRACRANIAL PART OF I.C.A

- * Course & relations: after emerging from the roof of the Cavernous sinus, the I.C.A bends upwards above the sinus & below the optic n. till it reaches the ant. perforated substance of the brain where it ends by dividing into its terminal branches.

* Branches:

- (1) ophthalmic a. : See orbit (page 92)
 - (2) ant. choroid a.
 - (3) post. communicating a.
 - (4) ant. cerebral a. } 2 terminal branches.
 - (5) middle cerebral a. }
- (see neuro anatomy for details).

* **Origin:** arises as one of the 2 terminal branches of C.C.A at the upper border of thyroid cartilage (disc between C₃, C₄).

* **Termination:** it ends behind the neck of mandible (inside parotid gland) by dividing into maxillary & superficial temporal arteries.

* **Course:**

- (1) it ascends on the side of the pharynx (outside the carotid sheath, superficial to I.C.A)
- (2) it passes deep to the post. belly of digastric m.
- (3) finally it enters a deep groove on the posteromed. surface of parotid then enters the gland (lying as the deepest structure inside the gland).

* **Relations:**

I- Superficial relations:

(A) From its origin up to the level of post. belly of digastric it has the same relations as I.C.A

- (1) Skin, superficial fascia & deep fascia.
- (2) ant. border of sternomastoid m.
- (3) Common facial & lingual veins.
- (4) hypoglossal n.
- (5) post. belly of digastric m.

(B) Above the level of post. belly of digastric it is related to:

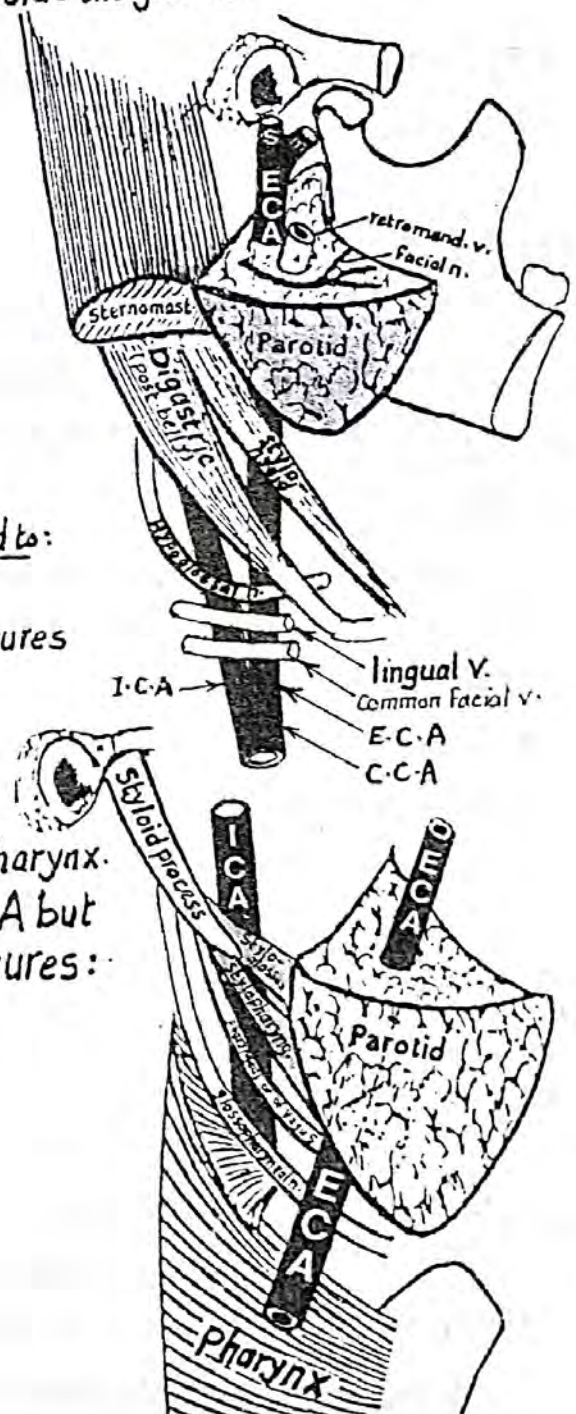
- (1) Stylohyoid m.
- (2) posteromed. surface of parotid gland & the structures inside it i.e. retromandibular v. & facial n.

II- Deep Relations:

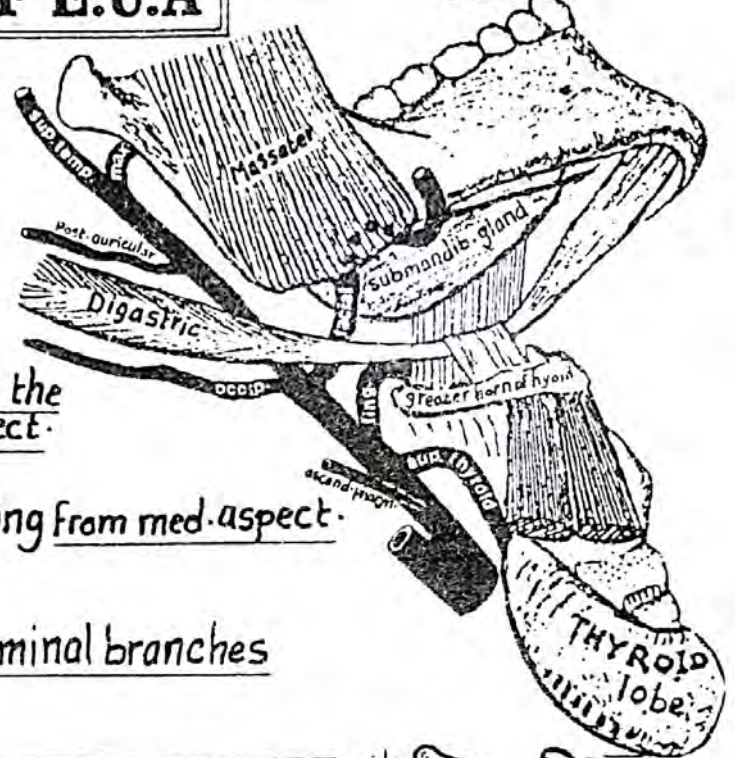
A - In the lower part: it is related to lat. wall of pharynx.

B - In the upper part: it is related to the I.C.A but separated from it by 6 structures:

- (1) Styloid process.
- (2) styloglossus m.
- (3) stylopharyngeus m.
- (4) glossopharyngeal n.
- (5) pharyngeal br. of vagus.
- (6) part of the parotid gland.



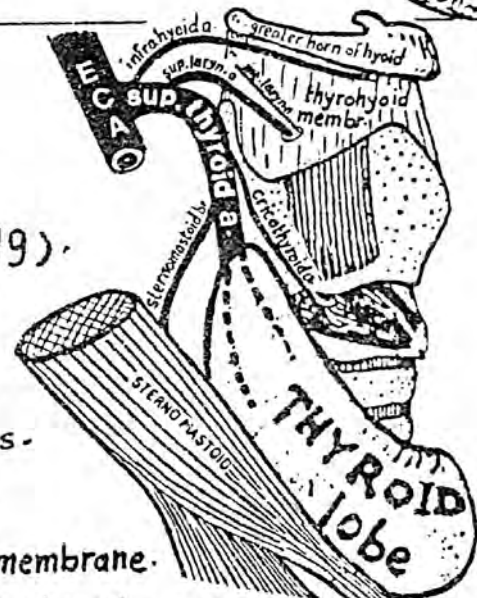
- (1) Sup. thyroid a.
 - (2) lingual a.
 - (3) facial a.
 - (4) Occipital a.
 - (5) post-auricular a.
 - (6) ascending pharyngeal a.:
 - (7) Maxillary a.
 - (8) superficial temporal a.
- } arise from the ant. aspect
 } arise from the post. aspect
 } arising from med. aspect
 } 2 terminal branches



(1) Sup. thyroid a.

- * Origin: from the ant. aspect of E.C.A below the greater horn of hyoid bone
- * Course & relations: see thyroid gland (page 119).
- * Branches:

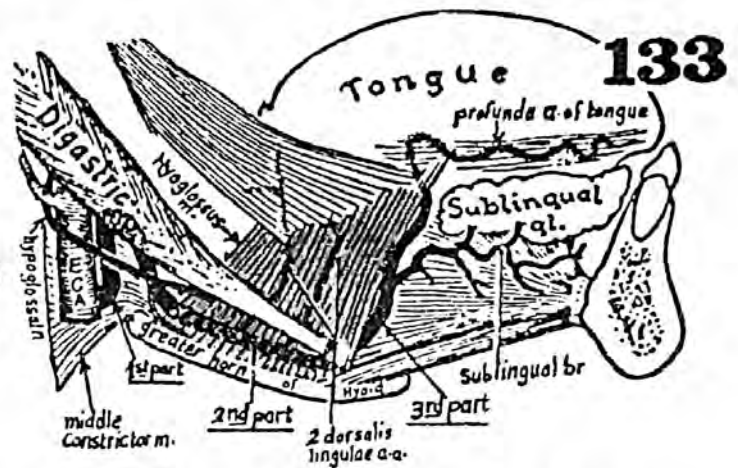
- (1) infrahyoid a.: runs along the lower border of hyoid bone to supply the infrahyoid muscles.
- (2) Sternomastoid br.: supplying sternomastoid m.
- (3) Cricothyroid br.: runs along the Crico-thyroid m. & membrane.
- (4) Sup. laryngeal a.: pierces the thyrohyoid memb. (with int. laryn. n.) to supply larynx.
- (5) terminal glandular branches to thyroid gland (supply upper $\frac{1}{3}$ of lat. lobe, upper $\frac{1}{2}$ isthm.)



(2) Lingual a.

- * Origin: from the ant. aspect of E.C.A opposite the greater horn of hyoid (above the sup. thyroid a.)
- * Course & relations: it runs a tortuous course which is divided by the hyoglossus m. into 3 parts:
- (1) First part: (from its origin till the post. border of hyoglossus m.): it forms a characteristic loop over the greater horn of hyoid bone.

- this loop lies on middle constrictor m. of pharynx & is crossed superficially by the digastric m. & hypoglossal n.



(2) Second part: runs horizontally forwards along the upper border of hyoid bone deep to hyoglossus m. & superficial to middle constrictor m. of pharynx.

(3) Third part: runs upwards along the ant. border of hyoglossus & is crossed by 3 structures: (1) lingual n. (2) submandibular duct (3) terminal branches of hypoglossal n.

* Termination: it ends by becoming the deep (profunda) a. of tongue which runs along the under surface of the tongue (accompanied by its vein) to reach the tip.

* Branches of lingual a.:

(1) 1st part: gives the suprahyoid a. passing superficial to hyoglossus above hyoid bone.

(2) 2nd part: gives 2 dorsalis lingulae aa.: ascending deep to hyoglossus to reach dorsum of tongue.

(3) 3rd part: gives the sublingual a. passing forwards on genioglossus to supply sublingual gland.

(3) Facial a.:

* Origin: from the ant. aspect of E.C.A above tip of greater horn of hyoid bone.

* Course & relations in the neck:

(1) it ascends vertically upwards deep to:

(a) post. belly of digastric (b) stylohyoid m. (c) angle of mandible & lying on the side of the pharynx:

First on middle constrictor, then on sup. constrictor which separates it from the palatine tonsil.

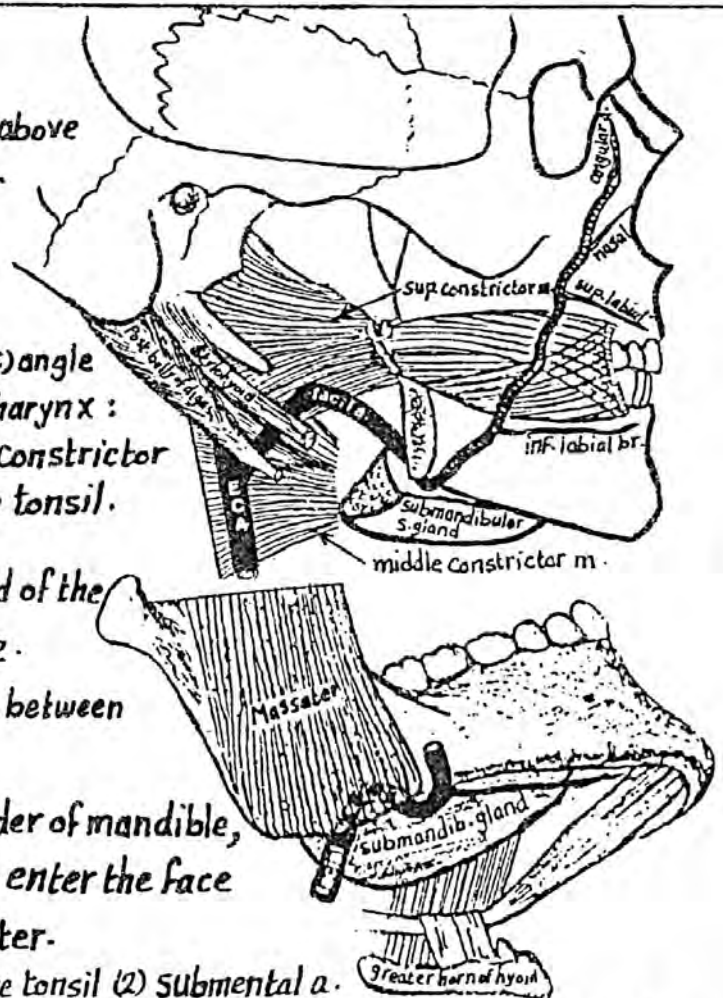
(2) it makes a deep groove on the post-end of the submandibular gland to reach its lat. surface.

(3) then it passes downwards & forwards between the gland and the mandible.

(4) Finally, it curves around the lower border of mandible, pierces the deep fascia of the neck to enter the face at the antero-inferior angle of masseter.

* Branches in the neck: (1) tonsillar brs. to the tonsil (2) submental a.

(3) glandular brs. to the submandibular salivary gland (4) ascending palatine to the soft palate.



(4) Occipital a.:

* Origin: from the back of E.C.A at the level of facial a.

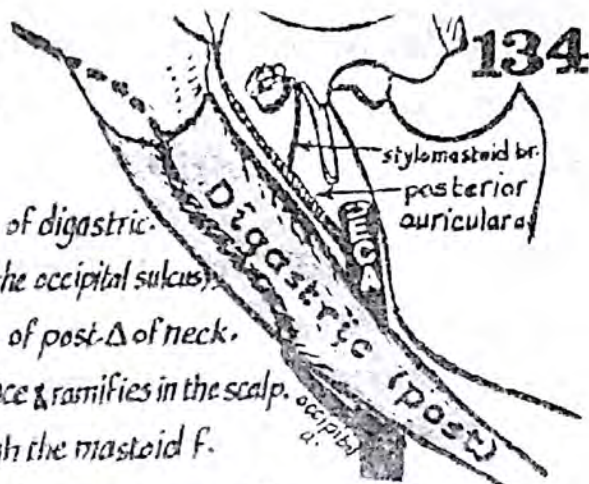
* Course: it has 4 parts:

- (1) 1st part: runs backwards deep to lower border of post. b. of digastric.
- (2) 2nd ": runs backwards med. to mastoid process (along the occipital sulcus).
- (3) 3rd ": runs along the sup. nuchal line crossing the apex of post. Δ of neck.
- (4) 4th ": pierces trapezius m. 1" lat. to ext. occ. protuberance & ramifies in the scalp.

* Branches: (1) mastoid br.: enters post. cranial fossa through the mastoid f.

(2) descending br.: descends between the muscles of the back to anastomose with deep cervical a.

(3) terminal occipital branches.



(5) Post-auricular a.:

* Origin: from post. aspect of E.C.A just above the post. belly of digastric m.

* Course: it runs backwards along the upper border of post. belly of digastric to reach the scalp behind the auricle accompanied by the post-auricular n.

* Branches: (1) stylo-mastoid br. (entering stylo-mastoid f.) (2) terminal brs. to the back of scalp.

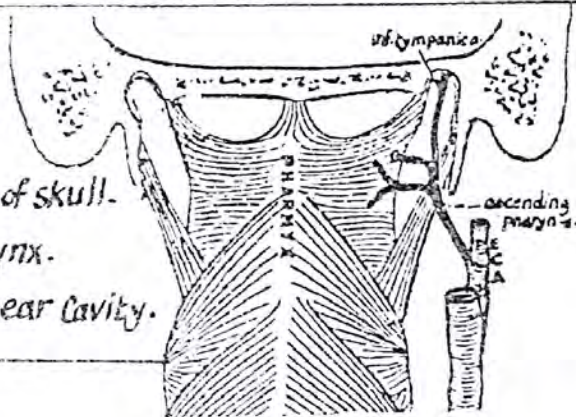
(6) Ascending pharyngeal a.:

* Origin: from the med. aspect of E.C.A (the 1st br.).

* Course: it ascends on the side of pharynx till the base of skull.

* Branches: (1) pharyngeal: to the wall of the pharynx.

(2) tonsillar: to the tonsil (3) inf. tympanic: to middle ear cavity.



(7) Superficial temporal a.:

* Origin: inside parotid gland (deep to the neck of mandible) as one of the 2 terminal branches of E.C.A.

* Course: it emerges from the upper pole of parotid, crosses the root of zygomatic arch with its vein in front of it & the auriculotemporal n. behind it (V.A.N). It ascends for 5 cm. in the temporal region then divides into ant. & post. terminal branches.

* Branches: (1) glandular: to the parotid gland.

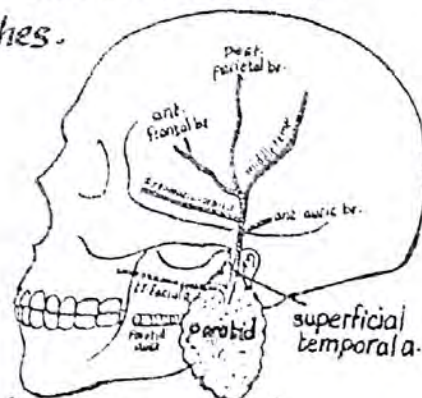
(2) transverse facial a. } see page 48

(3) zygomatico orbital a. }

(4) ant. auricular a.: to the auricle & ext. auditory meatus.

(5) middle temporal a.: the largest br.: runs deep to temporalis m. supplying it.

(6) terminal brs.: frontal & parietal branches running in the scalp over corresponding bones.



(8) Maxillary a.: described before (see page 62).

- * (1) Ant. jugular vein
 - * (2) Ext. jugular vein
- } see page 99

* 3-INTERNAL JUGULAR VEIN(I.J.V)

* Beginning : in the jugular foramen as a continuation of the sigmoid venous sinus.

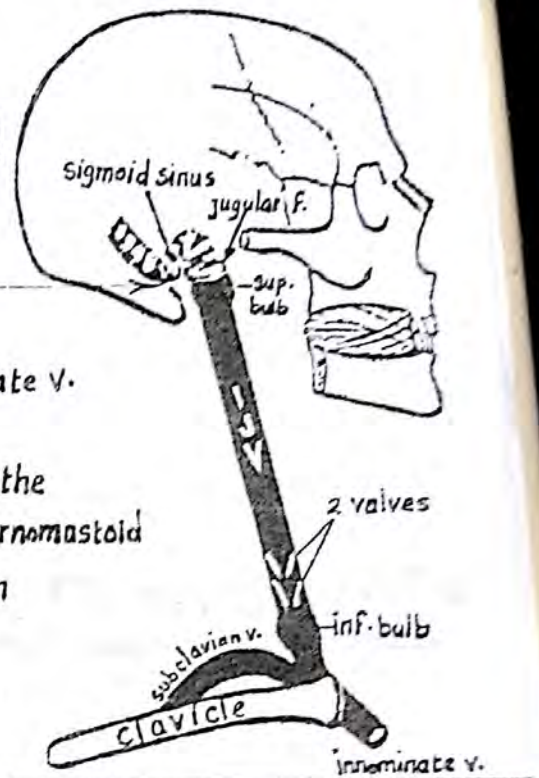
* Termination : behind the med. end of the clavicle by joining the subclavian v. to form innominate v.

* Course :

- it descends in the neck inside the Carotid sheath lat. to the I.C.A & C.C.A & posterolat. to vagus n. under cover of sternomastoid
- it has a dilatation at its upper end (sup. bulb) lodged in the jugular fossa.
- one cm. above the clavicle it has another dilatation (inf. bulb), above which there are 2 valves.

N.B : the Rt. I.J.V. is usually larger than the Lt. one.

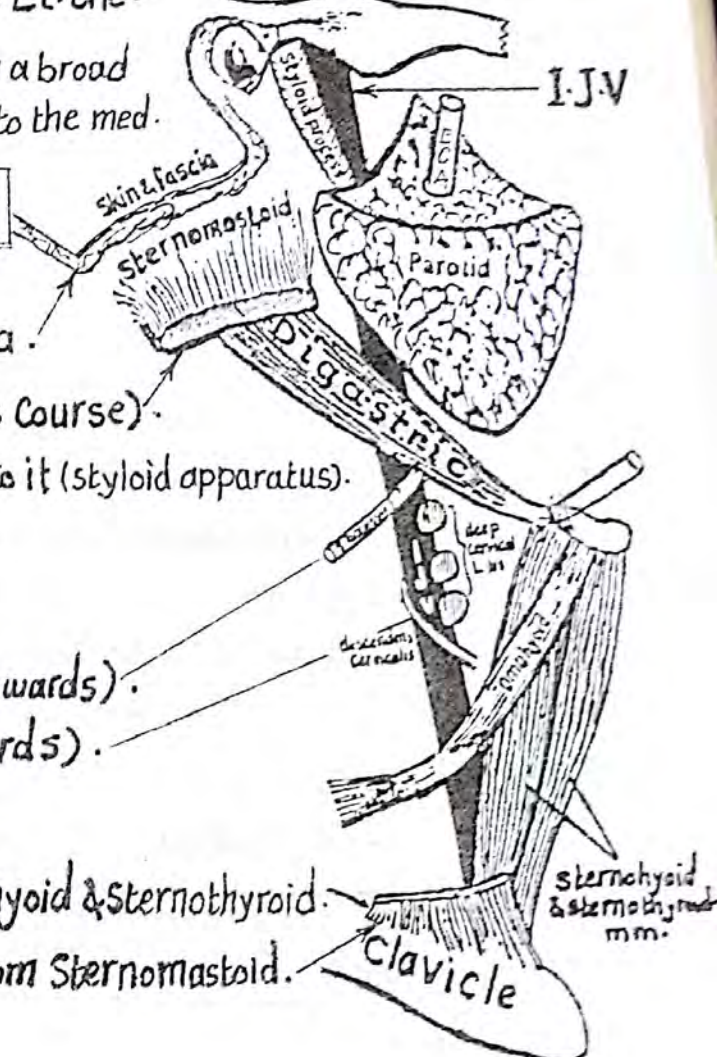
* Surface anatomy : it is represented by a broad vertical line drawn from the lobule of the ear to the med. end of the clavicle.



* RELATIONS

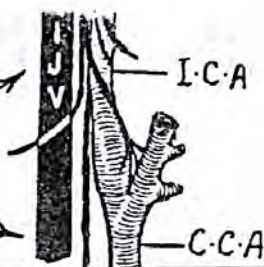
(A) Superficial relations :

- (1) Skin, superficial fascia & deep fascia.
- (2) Sternomastoid m. (Covering most of its course).
- (3) Styloid process & structures attached to it (styloid apparatus).
- (4) posteromed. surface of parotid gland.
- (5) posterior belly of digastric m.
- (6) spinal root of accessory n. (passing backwards).
- (7) descendens cervicalis n. (passing forwards).
- (8) deep cervical lymph nodes.
- (9) infrahyoid muscles : omohyoid, sternohyoid & sternothyroid. separating the lower part of the vein from Sternomastoid.



(B) Antero-medial relations:

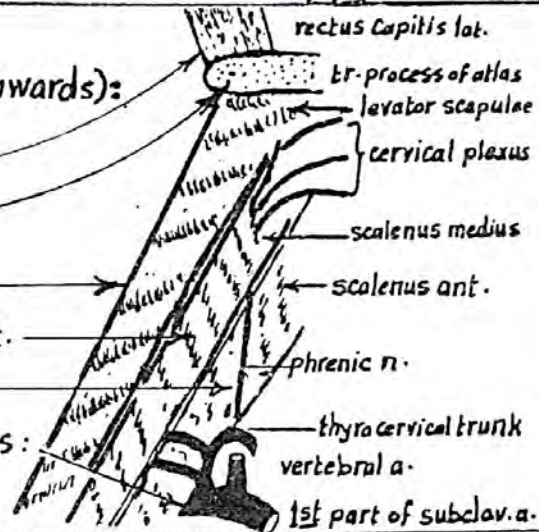
- (1) in the upper part : I.C.A & the last 4 cranial nerves
- (2) in the lower part : C.C.A & vagus n. only.



136

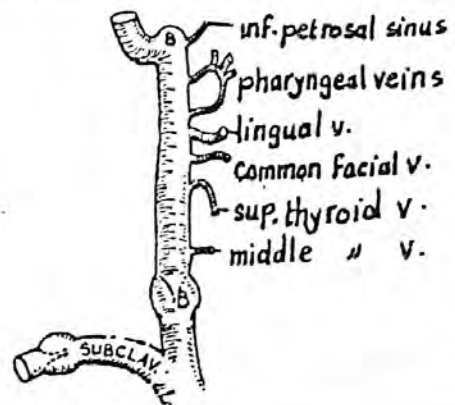
(C) Posterior relations: (from above downwards):

- (1) rectus Capitis lateralis m.
- (2) tr. process of atlas vertebra.
- (3) levator scapulae m.
- (4) Scalenus medius m. with cervical plexus on it.
- (5) Scalenus ant. m. with phrenic n. on it.
- (6) Subclavian a. (1st part) & 2 of its branches: vertebral a. & thyrocervical trunk



* Tributaries of I.J.V:

- (1) inf. petrosal sinus : joins the sup. bulb.
- (2) pharyngeal veins (draining the pharyngeal plexus of vv.)
- (3) lingual v.
- (4) Common facial v.
- (5) sup. thyroid v.
- (6) middle thyroid v.



4- SUBCLAVIAN VEIN

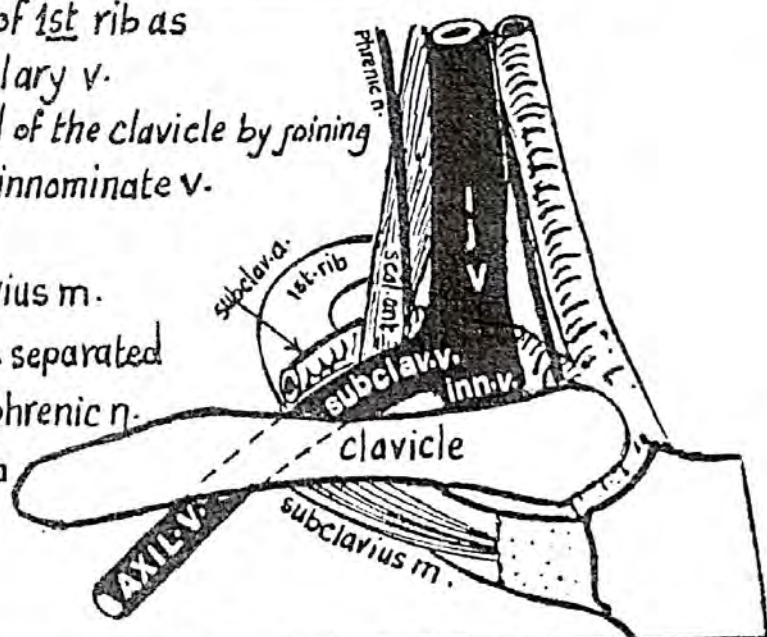
* Beginning: at the outer border of 1st rib as a continuation of axillary v.

* Termination: behind the med. end of the clavicle by joining the I.J.V to form the innominate v.

* Relations:

- anteriorly : clavicle & subclavius m.
- posterosuperiorly : subclavian a. separated from the vein by scalenus ant & phrenic n.
- inferiorly : 1st. rib & cervical pleura

* Tributaries : it has only one: the Ext. Jugular v.



5- VERTEBRAL VEIN : see page 190

The nerves of the H&N include :

- | | |
|----------------------------------|---------------------------------------|
| (1) Cranial nerves. | (2) Cervical nerves. |
| (3) Cervical sympathetic chains. | (3) parasympathetic ganglia & nerves. |

I-CRANIAL NERVES

- These are 12 pairs of nerves that arise inside the cranial cavity from the brain & the brain stem. They leave the skull through its foramina & fissures.

- They are numbered & named from before backwards as follows:

1st : Olfactory n.

2nd : Optic n.

3rd : Oculomotor n.

4th : Trochlear n.

5th : Trigeminal n.

6th : Abducent n.

7th : Facial n.

8th : Vestibulo-Cochlear n.

9th : Glossopharyngeal n.

10th : Vagus n.

11th : Accessory n.

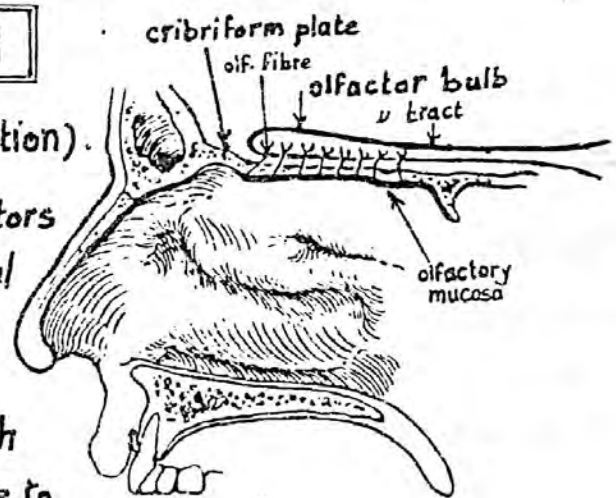
12th : Hypoglossal n.

1-OLFACTORY NERVE

* Type: Special Sensory n. (Carrying smell sensation).

* Origin: the olfactory n. fibres arise from receptors in the olfactory mucosa in the roof of nasal cavity (the fibres represent the central processes of the bipolar olfactory cells).

* Course: about 20 nerve fila (bundles) pass through the Cribiform plate of ethmoid on either side to end in the olfactory bulb of the brain. Each n. bundle is surrounded by a tubular sheath of meninges.



2-OPTIC NERVE

(see p. 88)

3-OCULOMOTOR NERVE

(see page 91)

4-TROCHLEAR NERVE

(See page 91)

5-TRIGEMINAL NERVE

138

mesencephalic nucleus

* it is the thickest Cranial n.

* **Type** : mixed n. (motor & sensory).

- its sensory fibres receive sensations from : ant. $\frac{1}{2}$ of scalp, face, orbit, nasal cavity & oral cavity.

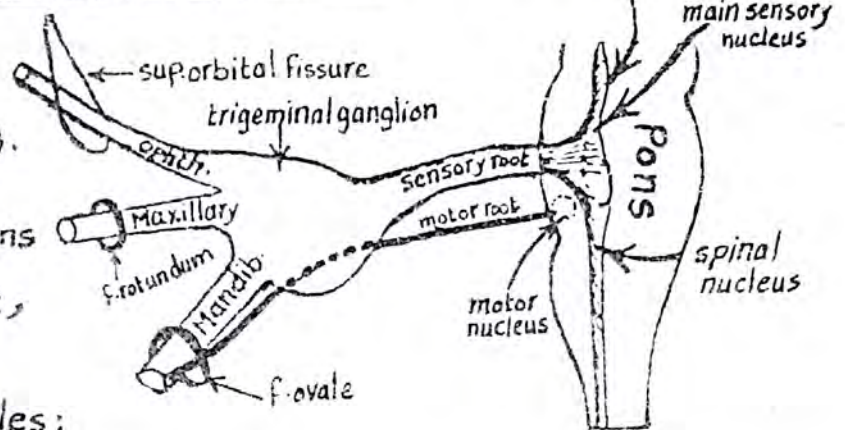
- its motor fibres supply 8 muscles :

the 4 muscles of mastication + 4 other muscles.

* **Origin** : arises by a large sensory root & small motor root which are attached to the lat. surface of the pons.

(A) the sensory root : is formed by the central processes of the bipolar cells of trigeminal ganglion which reach the mesencephalic, main sensory & spinal nuclei of trigeminal n.

(B) the motor root : arises from the motor nucleus of trigeminal n. & passes below the trigeminal ganglion to join the mandibular n. in the foramen ovale.



Trigeminal ganglion

* it is a sensory ganglion in the course of the sensory root of trigeminal n.

* **Site** : in the middle cranial fossa occupying the trigeminal impression at the apex of the petrous temporal bone inside a dural recess called Cavum trigeminale.

* **Connections** : the ganglion contains bipolar sensory cells

- the Concave aspect of the ganglion is directed backwards & joins the sensory root of trigeminal n. which contains the central processes of the bipolar cells.

- the Convex aspect of the ganglion is directed forwards & gives rise to the ophthalmic, maxillary & mandibular nerves (containing the peripheral processes of the bipolar cells).

* **Branches of the ganglion** :

(1) ophthalmic n. : (the smallest) : See page 88

(2) maxillary n. : (medium sized) : See page 59

(3) mandibular n. : (the largest) : See page 54

6-ABDUCENT NERVE

: page : 92

7-FACIAL NERVE

* **Type**: mixed nerve (Containing motor, sensory & parasymp. fibres).

* **Origin**: it emerges from the anterolateral aspect of the brain stem at the lower border of pons (pono-cerebellar angle).

* **Components of facial nerve**: it is formed of 2 parts:

(1) Facial n. proper: (motor): arising from the facial motor nucleus in the pons.

(2) Nervus intermedius: Carrying:

(a) parasymp. fibres (from sup. salivary nucleus).

(b) taste fibres (from the solitary nucleus).

A- Intracranial Course of Facial N.

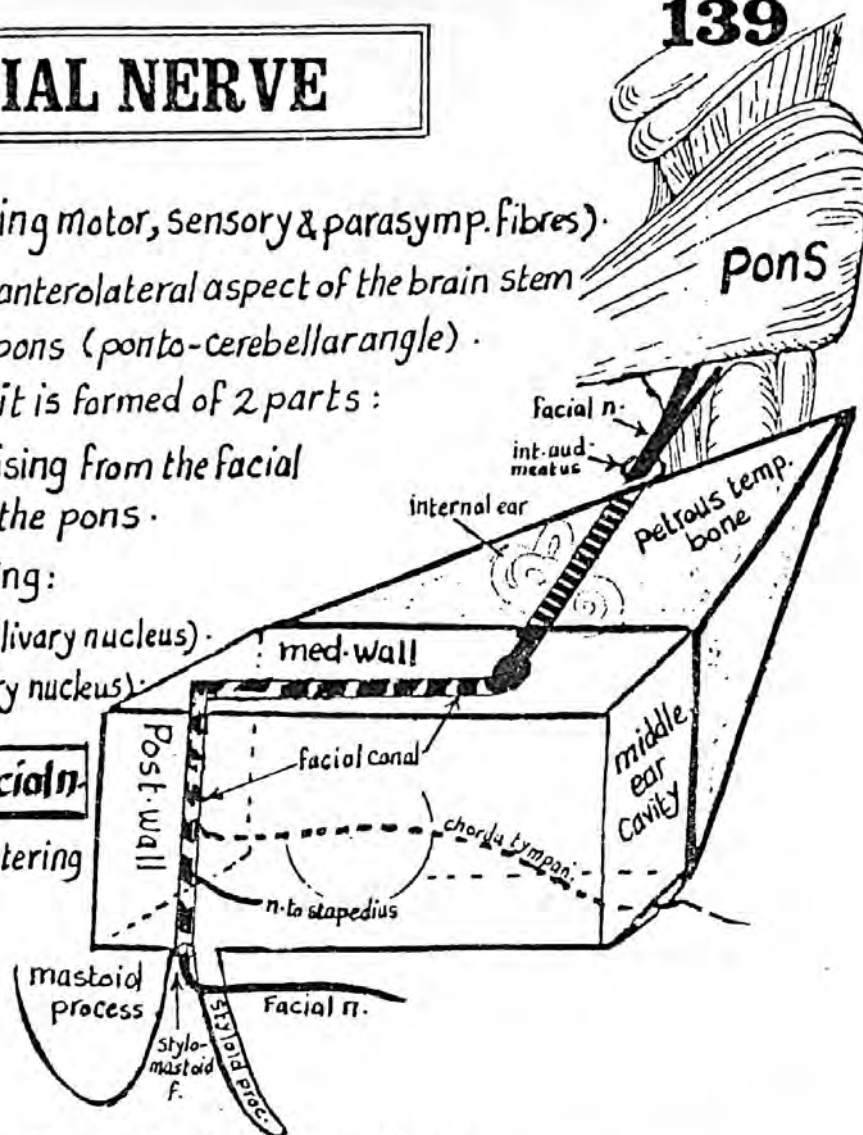
(1) it leaves the Cranial Cavity by entering the internal auditory meatus.

(2) it runs through a bony canal (facial canal) inside petrous temporal bone as follows:

(a) it runs first laterally above the vestibule of internal ear.

(b) then it turns backwards in the upper part of med-wall of middle ear cavity (horizontal part of the facial canal).

(c) finally it passes downwards in the post-wall of middle ear cavity (vertical part of the facial canal) to reach the stylomastoid foramen.



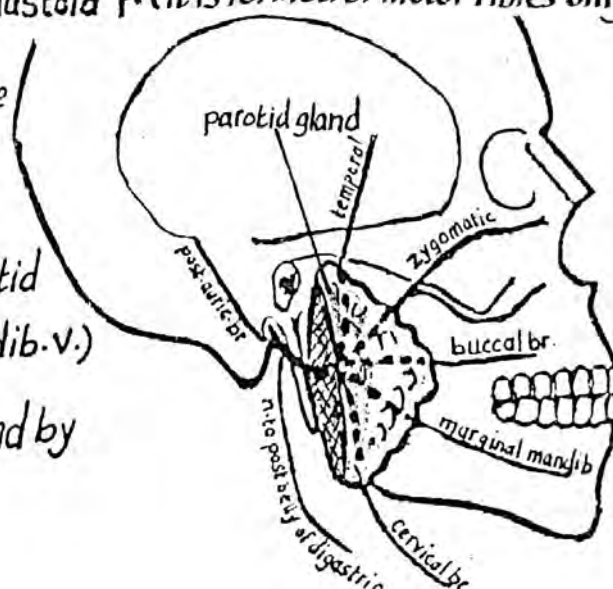
B- ExtraCranial Course of Facial N.:

(1) it leaves the facial canal through the Stylomastoid f. (it is formed of motor fibres only).

(2) it turns forwards making a curve around the lat. side of base of styloid process.

(3) it enters the posteromedial surface of parotid gland (lying superficial to E.C.A & retromandib. v.)

(4) it ends inside the substance of the gland by dividing into 5 terminal branches.



Branches of facial N.

140

I- Branches of the intrapetrous part:

(1) Greater Superficial petrosal n.

- it is a parasymp. n. whose fibres are derived from the nervus intermedius component of facial n.
- Origin: from the geniculate ganglion of facial n.
- Course:

- (1) it leaves the petrous temporal bone via hiatus carrying its name to reach middle cranial fossa
- (2) it passes forwards in a groove carrying its name on the ant. surface of petrous temporal bone.
- (3) it enters the f. lacerum where it joins the deep petrosal n. (symp. n. from plexus around I.C.A.) to form the n. of pterygoid canal (Vidian n.).
- (4) the vidian n. passes through the pterygoid canal to reach the pterygopalatine fossa.
- (5) in the fossa, the parasymp. fibres of the G-S-petrosal n. relay in the sphenopalatine ganglion.
- (6) the postganglionic fibres pass with the branches of the sphenopalatine ganglion to supply the mucous glands of the palate, nose, nasopharynx & also supply the lacrimal gland.

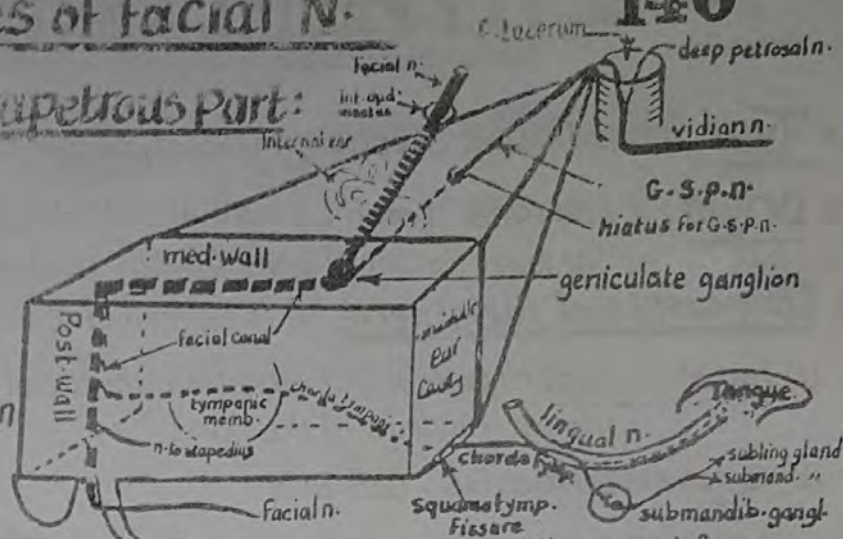
(2) Chorda tympani n.:

- it is a parasymp. & sensory n. (taste) derived from the nervus intermedius part of facial n.
 - Origin: it arises from facial n. as it descends in the post. wall of middle ear cavity.
 - Course & distribution:
- (1) it traverses the middle ear cavity from behind forwards lying very close to tympanic memb.
 - (2) it leaves the middle ear cavity through the squamotympanic fissure.
 - (3) it enters the infratemporal fossa where it joins the lingual n. deep to the lat. pterygoid m.
 - (4) the parasymp. fibres of Chorda tympani leave the lingual n. to relay in the submandib. ganglion. The postganglionic fibres supply the submandib. & sublingual salivary glands.
 - (5) the taste fibres of the Chorda tympani continue with lingual n. to supply the mucous memb. of the ant 2/3 of the tongue.

(3) Nerve to Stapedius m. : a small motor n. supplying the stapedius m. in the middle ear cavity.

II- Branches of the extracranial Part of facial N.:

- (1) n. to post. belly of digastric & stylohyoid m.
 - (2) post. auricular n. to occipitalis & auricularis post. mm
 - (3) the 5 terminal branches of facial n. in the parotid gland : See page : 45
- } arise from facial n. before it enters the parotid gland.



8-VESTIBULO-COCHLEAR NERVE

(Stato-acoustic or auditory)

141

* Type: special sensory n. formed of 2 parts

(1) Cochlear part: Carrying hearing impulses.

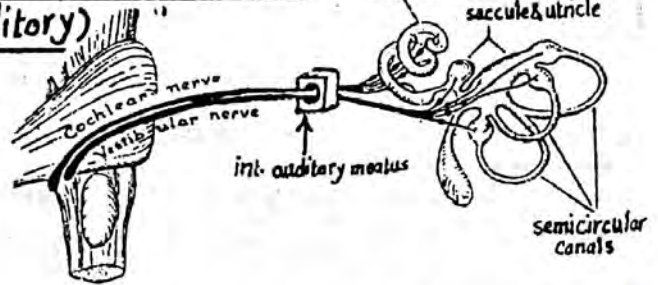
(2) Vestibular part: " equilibrium "

* Superficial attachment to the brain:

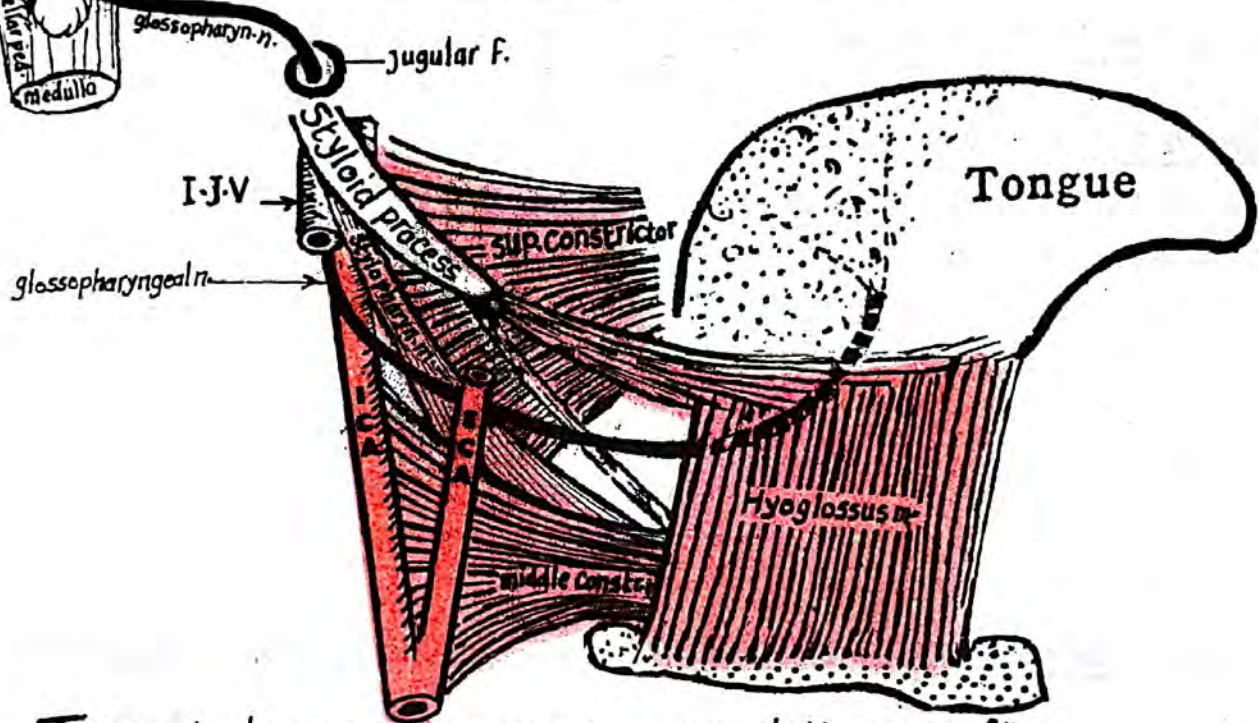
* Course: it enters the internal auditory meatus (with facial n.). where:

- the Cochlear part ends in the cochlea.

- the Vestibular part ends in the utricle, saccule & the 3 semicircular canals.



9-GLOSSO-PHARYNGEAL NERVE



* Type: mixed n. Containing sensory, parasympathetic & motor fibres

* Origin: From posterolateral sulcus of medulla (between olive & inf. cerebellar peduncle).

* Course & relations:

(1) it leaves the Cranial Cavity through the middle Compartment of jugular foramen.

(2) it descends downwards between I-J-V & I-C-A (in the upper part of Carotid sheath) lying deep to the styloid process & muscles attached to it.

(3) then it leaves the Carotid sheath & passes forwards with stylopharyngeus m. between the I-C-A & the E-C-A.

(4) then it disappears deep to the post. border of hyoglossus m (in the gap between the sup. & the middle constrictor m.) & ascends deep to hyoglossus to reach the tongue.

* **Termination**: it ends by dividing into terminal branches supplying the mucous membranes of pharynx, tonsil & the post. $\frac{1}{3}$ of tongue.

* **Ganglia of glossoph. n.**: it has 2 sensory ganglia in the jugular foramen:

(1) sup. ganglion: small & gives no branches

(2) inf. ganglion: larger & gives tympanic br.

* **Branches**:

(1) Meningeal br.: sensory to the meninges of Post. Cranial fossa.

(2) Carotid br.: sensory to the carotid sinus & carotid body

(3) nerve to stylopharyngeus m. (motor).

(4) Pharyngeal branches (sensory):

they enter in the formation of the pharyngeal plexus on the lat. surface of the middle constrictor m. of pharynx. & through this plexus sensory fibres are distributed to the m. membrane of pharynx.

N.B: the pharyngeal plexus receives also:

(a) motor br.: the pharyngeal br. of vagus.

(b) symp. br.: the pharyngeal br. of the sup. cervical symp. ganglion.

(5) Tonsillar branch (sensory): shares the lesser palatine n. in supplying palatine tonsil.

(6) Terminal lingual branches: supply general & taste sensations to the post. $\frac{1}{3}$ of tongue.

(7) Tympanic br. (Jacobson's n.): preganglionic parasymp. to parotid gland.

- Origin: arises from the inf. ganglion of glossopharyngeal n. in the jugular fossa.

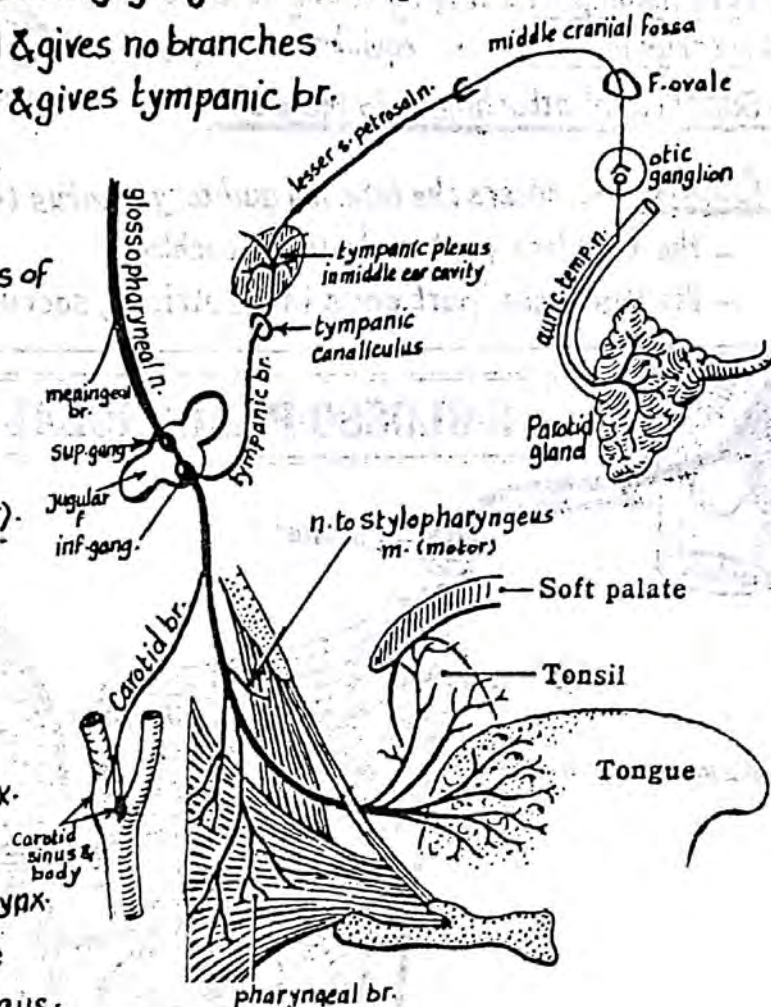
- Course: (1) it passes through the tympanic canaliculus in the jugular fossa.

(2) it reaches the middle ear cavity where it breaks to form the tympanic plexus.

(3) lesser s. petrosal n. arises from the tympanic plexus & reaches the middle cranial fossa via hiatus carrying its name.

(4) then the lesser s. petrosal n. passes through the f. ovale to reach the infra temporal fossa to relay in the otic ganglion.

(5) the postganglionic fibres join the auriculo temporal n. to reach parotid gland.



10-VAGUS NERVE

143

* **Type** : mixed n. Containing : parasymp, motor & sensory fibres

* **Origin** : from postero-lateral sulcus of medulla

* **Course & relations in the neck** :

- (1) it leaves the cranial cavity through the middle compartment of the jugular f. Here it has 2 sensory ganglia : sup. ganglion (in the jugular f.) & inf. ganglion (just below the jugular foramen).
- (2) the cranial root of accessory n. joins the inf. ganglion of vagus just below the jugular f. (its fibres are distributed with the branches of this ganglion).
- (3) the vagus descends vertically downwards inside the Carotid sheath :
 - first between I.J.V & I.C.A (passing with them deep to the styloid apparatus & post. belly of digastric m.) till the upper border of thyroid cartil.
 - lower down, it descends between the I.J.V & C.C.A.
 N.B: the vagus usually lies between the artery & the vein but at post. plane.

- (4) At the root of the neck, the vagus n. crosses in front of first part of subclavian a. to enter the thorax.

* **Branches of the Vagus in the neck** :

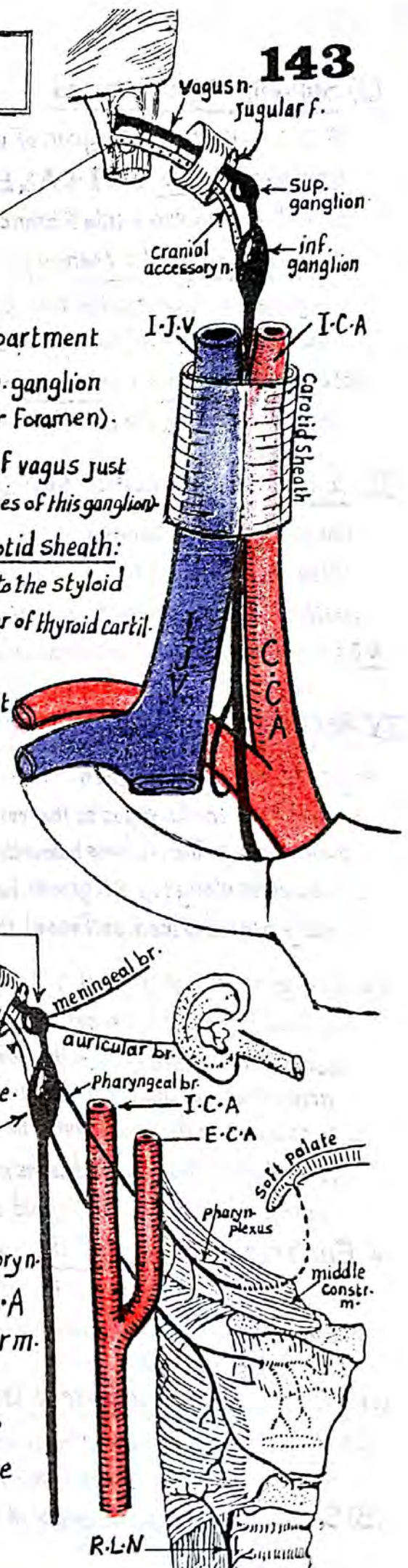
I- 2 branches arise from the Sup. ganglion:

- (1) meningeal br. sensory to the dura mater of the post. Cranial fossa.
- (2) auricular br. sensory to the skin of med. side of auricle, post. wall of ext. auditory meatus & tympanic membrane.

II- 2 branches arise from the inferior ganglion.

(1) pharyngeal br. (motor) :

- its fibres are mostly derived from the cranial accessory n.
- it descends downwards & forwards between the I.C.A & the E.C.A to reach lat. surface of middle constrictor m. to share in the formation of the pharyngeal plexus.
- its fibres supply the pharyngeal muscles (except the stylopharyngeus m.) + all muscles of the soft palate (except the tensor palati m.).



144

inf. ganglion

I.C.A.

E.C.A.

pharyngeal br.

sup. laryngeal n.

Ext. laryngeal n.

sup. n. a.

thyrohyoid memb.

ext. laryn.-n.

cricothyroid

sup. thyroid a.

sup. & inf. cardiac branches

-
- 144
- inf. ganglion
- I.C.A.
- E.C.A.
- pharyngeal br.
- sup. laryngeal n.
- Ext. laryngeal n.
- sup. n. a.
- thyrohyoid memb.
- ext. laryn.-n.
- cricothyroid
- sup. thyroid a.
- sup. & inf. cardiac branches

144

inf. ganglion

I.C.A.

E.C.A.

pharyngeal br.

sup. laryngeal n.

Ext. laryngeal n.

sup. n. a.

thyrohyoid memb.

ext. laryn.-n.

cricothyroid

sup. thyroid a.

sup. & inf. cardiac branches

-
- 144
- inf. ganglion
- I.C.A.
- E.C.A.
- pharyngeal br.
- sup. laryngeal n.
- Ext. laryngeal n.
- sup. n. a.
- thyrohyoid memb.
- ext. laryn.-n.
- cricothyroid
- sup. thyroid a.
- sup. & inf. cardiac branches

-

-

-

-
- 144
- inf. ganglion
- I.C.A
- E.C.A
- pharyngeal br.
- sup. laryngeal n.
- Ext-laryngeal n.
- sup. n. a.
- thyroid memb
- ext. laryn.-n.
- cricothyroid
- sup. thyroid a.
- sup. & inf. cardiac branches

144

inf. ganglion

I.C.A

E.C.A

pharyngeal br.

sup. laryngeal n.

Ext-laryngeal n.

sup. n. a.

thyroid memb

ext. laryn.-n.

cricothyroid

sup. thyroid a.

sup. & inf. cardiac branches

144

inf. ganglion

I.C.A

E.C.A

pharyngeal br.

sup. laryngeal n.

Ext-laryngeal n.

sup. n. a.

thyroid memb

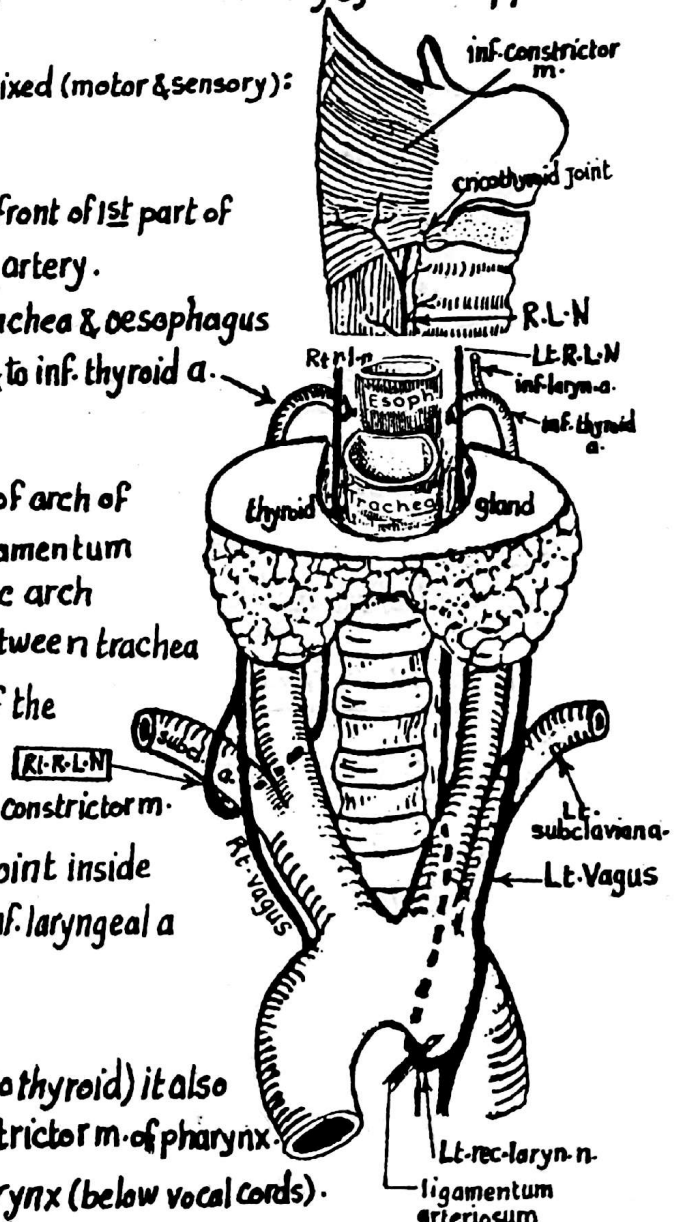
ext. laryn.-n.

cricothyroid

sup. thyroid a.

sup. & inf. cardiac branches

-
- 144
- inf. ganglion
- I.C.A
- E.C.A
- pharyngeal br.
- sup. laryngeal n.
- Ext-laryngeal n.
- sup. n. a.
- thyroid memb
- ext. laryn.-n.
- cricothyroid
- sup. thyroid a.
- sup. & inf. cardiac branches



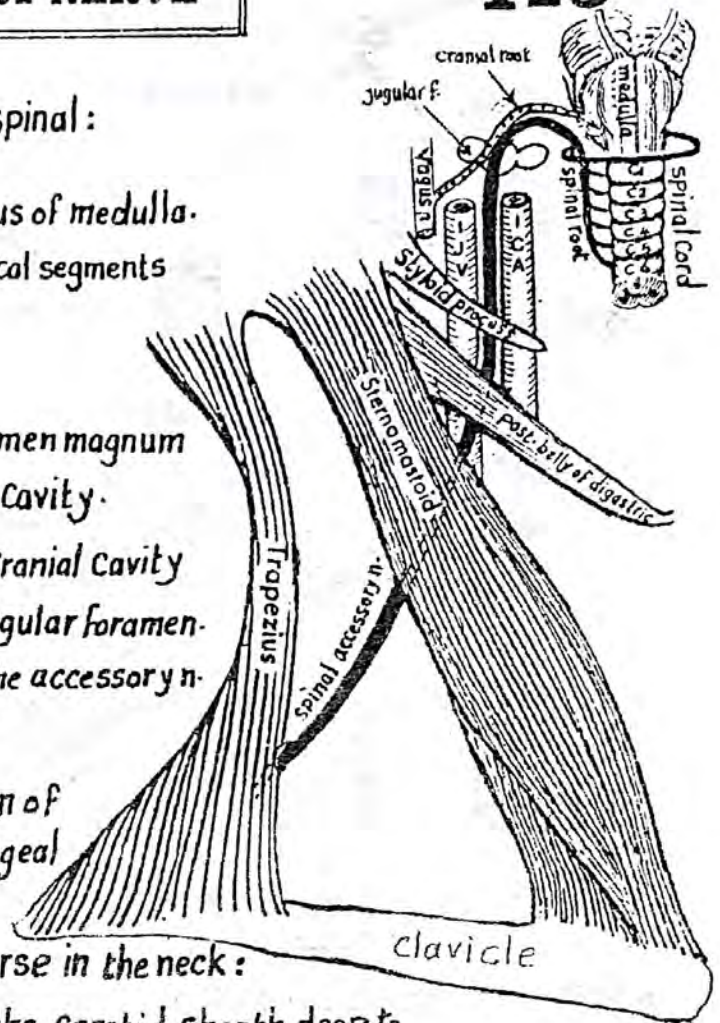
* **Type**: purely motor n.

* **Origin**: it arises by 2 roots: cranial & spinal:

- (1) Cranial root: arises from the posterolat. sulcus of medulla.
- (2) Spinal root: arises from the upper 5 or 6 cervical segments of the spinal cord.

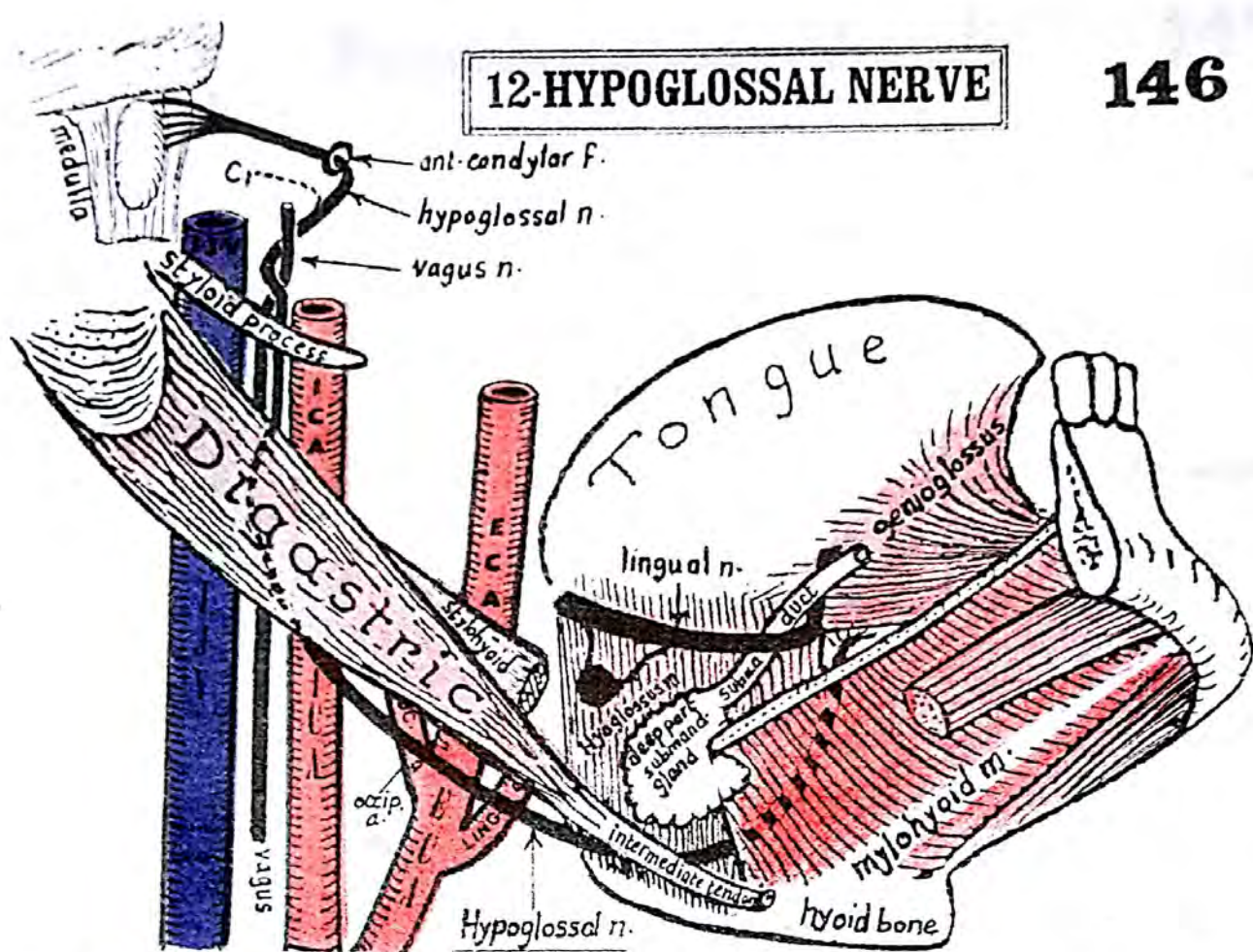
* **Course & relations**:

- (1) the spinal root ascends through the Foramen magnum to join the Cranial root inside the Cranial Cavity.
- (2) the **United** accessory n. then leaves the Cranial Cavity through the middle compartment of the jugular foramen.
- (3) Just below the jugular f. the 2 roots of the accessory n. separate from each other.
- (4) the Cranial root: joins the inf. ganglion of vagus n. & is distributed with its pharyngeal and laryngeal branches.
- (5) the Spinal root: has the following course in the neck:
 - (a) it descends inside the upper part of the Carotid Sheath deep to the styloid apparatus & between the I.J.V. & the I.C.A.
 - (b) then it passes backwards between the I.J.V & post. belly of digastric m.
 - (c) it pierces the deep surface of sternomastoid m, supplying it then it emerges from its post. border above its middle.
 - (d) it crosses the post. Δ of the neck (lying close to its fascial roof).
 - (e) finally it pierces the ant. border of trapezius m. about 5 cm. above the clavicle & ends by supplying it.



* **Branches of the Accessory n.**

- (1) the cranial accessory n.: joins the vagus n. & is distributed with its:
 - (a) pharyngeal br.: supplying all muscles of pharynx (except stylopharyngeus) & all muscles of palate (except tensor palati m.).
 - (b) laryngeal branches supplying the muscles of the larynx.
- (2) the Spinal accessory n.: supplies 2 muscles:
 - (1) Sternomastoid
 - (2) Trapezius.



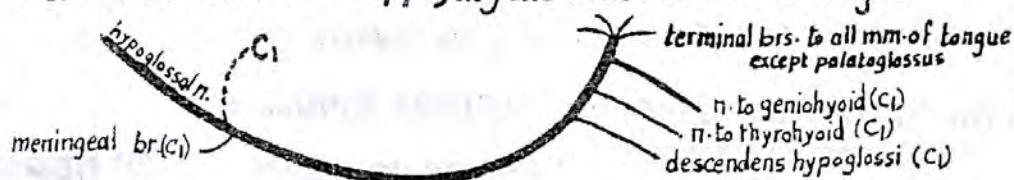
***Type:** purely motor n. It supplies all intrinsic & extrinsic muscles of the tongue except palatoglossus.

***Origin:** from the anterolateral sulcus of medulla. It receives a communicating br. from C₁.

***Course & relations:**

- (1) it leaves the cranial cavity through the ant. condylar foramen then forms a half spiral turn around vagus n.
- (2) then it descends vertically downwards inside the upper part of carotid sheath superficial to vagus n. between I.J.V & I.C.A.
- (3) it descends deep to the styloid process, stylohyoid m. & post-belly of digastric m.
- (4) then it turns forwards crossing the following structures successively:
 - (a) I.C.A (b) occipital a. (c) E.C.A (d) the loop of the lingual a.
- (5) it disappears deep to the intermediate tendon of digastric m. to reach the submandibular region where it runs on hyoglossus m. & covered superficially by submandib. gland.
- (6) it disappears deep to mylohyoid m. below the lingual n. & the submandibular duct.
- (7) finally it dips in the interval between the hyoglossus & the genioglossus where it breaks into terminal branches supplying the muscles of the tongue.

***Branches:**



4 Branches arising from hypoglossal n. itself	4 Branches derived from C ₁ joining hypoglossal n.
(1) n. to styloglossus m. (2) n. to hyoglossus m. (3) n. to genioglossus m. (4) nn. to all intrinsic muscles of tongue	(1) meningeal br. (sensory) to dura mater (2) n. to geniohyoid m. (3) n. to thyrohyoid m. (4) descendens hypoglossi forming the sup limb of ansa cervicalis (supplying infrahyoid muscles)

CERVICAL PLEXUS

* it is a nerve plexus lying in the upper part of neck & formed by the ant. rami of the upper 4 cervical nerves.

* Site & relations : it lies opposite the upper 4 cervical transverse processes.

- superficial relations : Sternomastoid & I-J-V

- deep relations : levator scapulae & scalenus medius muscles.

* Formation : It is formed by the ant. rami of C₁, C₂, C₃ & C₄

- each ventral ramus divides into ascending & descending branch

- the ascending & descending branches of all rami join each other forming the loops of the cervical plexus.

* Branches :

I- Cutaneous : appear at the middle of post. border of sternomastoid & include:

(1) lesser occipital (2) great auricular (3) tr. cut. n. of neck (4) supraclavicular n.

Course & distribution : see superficial fascia of the neck : (page 98) .

II Communicating :

(1) it gives communicating br. to the hypoglossal n. from C₁ .

(2) it receives grey rami communicantes (to all its roots) from the sup. cervical ganglion of the sympathetic chain.

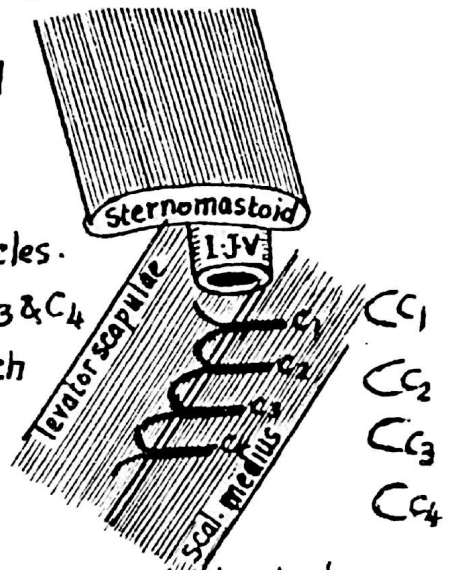
III Muscular :

(1) branches to scalene muscles & prevertebral muscles .

(2) branches to Sternomastoid (C₂), trapezius (C_{3,4}) & levator scapulae (C_{3,4})

(3) descendens cervicalis (C_{2,3}) : forming the inf. limb of the ansa cervicalis which supplies the infrahyoid muscles .

(4) phrenic n. (C_{3,4,5} mainly C₄) . : See page 148 .



PHRENIC NERVES

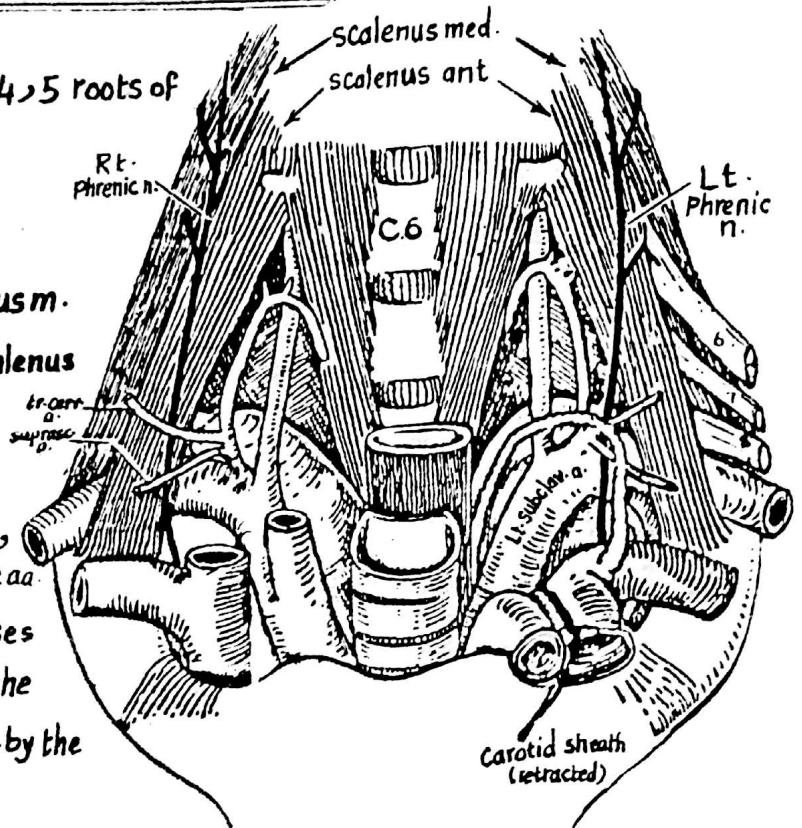
148

* Type : mixed n.

* Origin : from the ant. rry rami of C₃, 4, 5 roots of the Cervical plexus.

Course & relations in the neck :

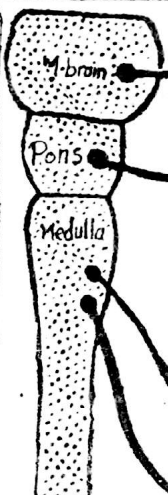
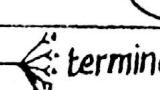
- (1) at its origin it lies on scalenus medius m.
- (2) then it descends obliquely in front of scalenus ant. m. crossing it from lat to medial (between the muscle & its fascia) .It is covered superficially by sternomastoid, I. J. V. & Crossed by the tr. cervical & suprascap. aa.
- (3) At the root of neck, the Lt. phrenic crosses in front of 1st part of subclavian a. while the Rt. phrenic is separated from subclavian a. by the scalenus ant. m.
- (4) Then each phrenic n. enters the thorax by passing behind the beginning of the innominate V.



* Distribution :

- (1) its motor fibres supply the diaphragm
 - (2) its Sensory fibres supply "3 Ps"
 - (1) pericardium
 - (2) pleura covering the diaphragm
 - (3) peritoneum on the lower surface of diaphragm.
- N.B : the Rt. phrenic supplies the gall bladder.

PARASYMP. NERVES & GANGLIA IN THE H&N

Cranial parasymp. nerve	Parasymp. ganglion of relay	Structures supplied
 Oculomotor n. (Page 91)	 (page 90)	sphincter pupillae m Ciliary muscle
Facial n. (see page 140) ch. tympani gr. s. petrosal	 page 58  page 61	submandib. salivary gland sublingual " " to mucous glands of the palate, nose, nasopharynx, periosteum of orbit & to the lacrimal gland.
Glossopharyngeal n. (see page 142)	 page 57	to parotid gland
Vagus n.	 terminal ganglia	to heart, respiratory tract G.I.T.

I- Course & relations:

- it descends vertically in the neck embedded in the post. wall of the Carotid sheath opposite the transverse process of the Cervical vertebrae.
- ant-relations: I.C.A (above) & C.C.A (below).
- post-relations: longus Capitis & longus Colli muscles.
- Superiorly: it ends by the sup. ganglion below base of skull.
- inferiorly: it crosses the neck of 1st rib to enter the thorax.

II- Ganglia: it has 3 ganglia:

1- SUP. CERVICAL SYMP. GANGLION

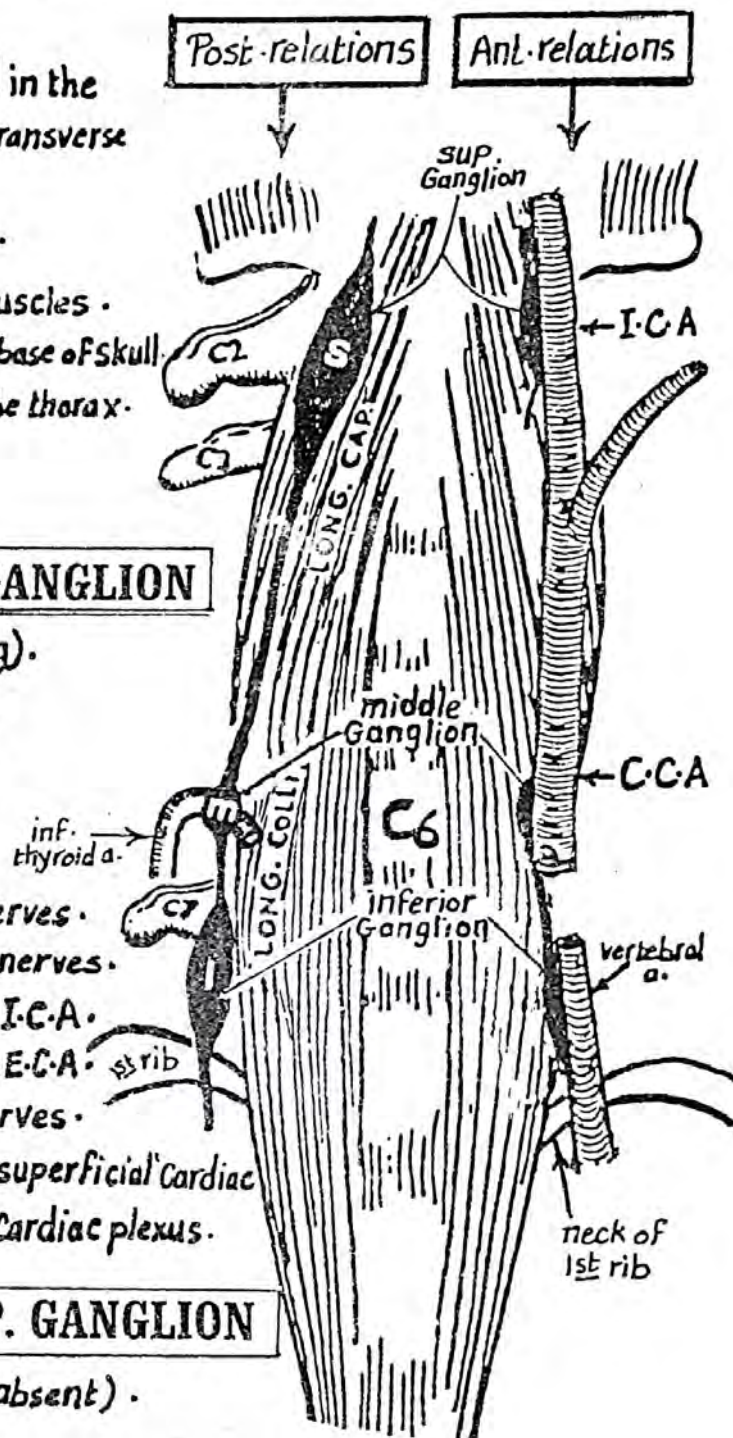
- * Size: it is the largest ganglion (2-3 cm long).
- * Site: opposite the 2nd & 3rd cervical vertebrae.
- * relations: anteriorly: I.C.A (inside carotid sheath).
posteriorly: longus Capitis m.
- * Branches:

- (1) Communicating branches to the last 4 Cranial nerves.
- (2) grey rami communicantes to the upper 4 cervical nerves.
- (3) int. Carotid n. forming a symp. plexus around the I.C.A.
- (4) ext. Carotid n.: forming a symp. plexus around the E.C.A.
- (5) pharyngeal br.: joins the pharyngeal plexus of nerves.
- (6) Cardiac br.: the br. of the Lt. ganglion ends in the superficial Cardiac plexus while that of the Rt. ganglion ends in the deep Cardiac plexus.

2- MIDDLE CERVICAL SYMP. GANGLION

- * Size: it is the smallest ganglion (it may be absent).
- * Site: lies opposite the 6th cervical vertebra.
- * relations: anteriorly: C.C.A
posteriorly: inf. thyroid a.
- * Branches:

- (1) grey rami communicantes to the 5th & 6th Cervical nerves.
- (2) thyroid branches: forming a plexus around the inf. thyroid a. to reach thyroid gland.
- (3) Cardiac br. descends to join the deep Cardiac plexus in the deep Cardiac plexus.
- (4) ansa subclavia: a br. from the middle ganglion which forms a loop around the 1st part of subclavian a. to join the inf. cervical symp. ganglion.



3- INF. CERVICAL SYMP. GANGLION

150

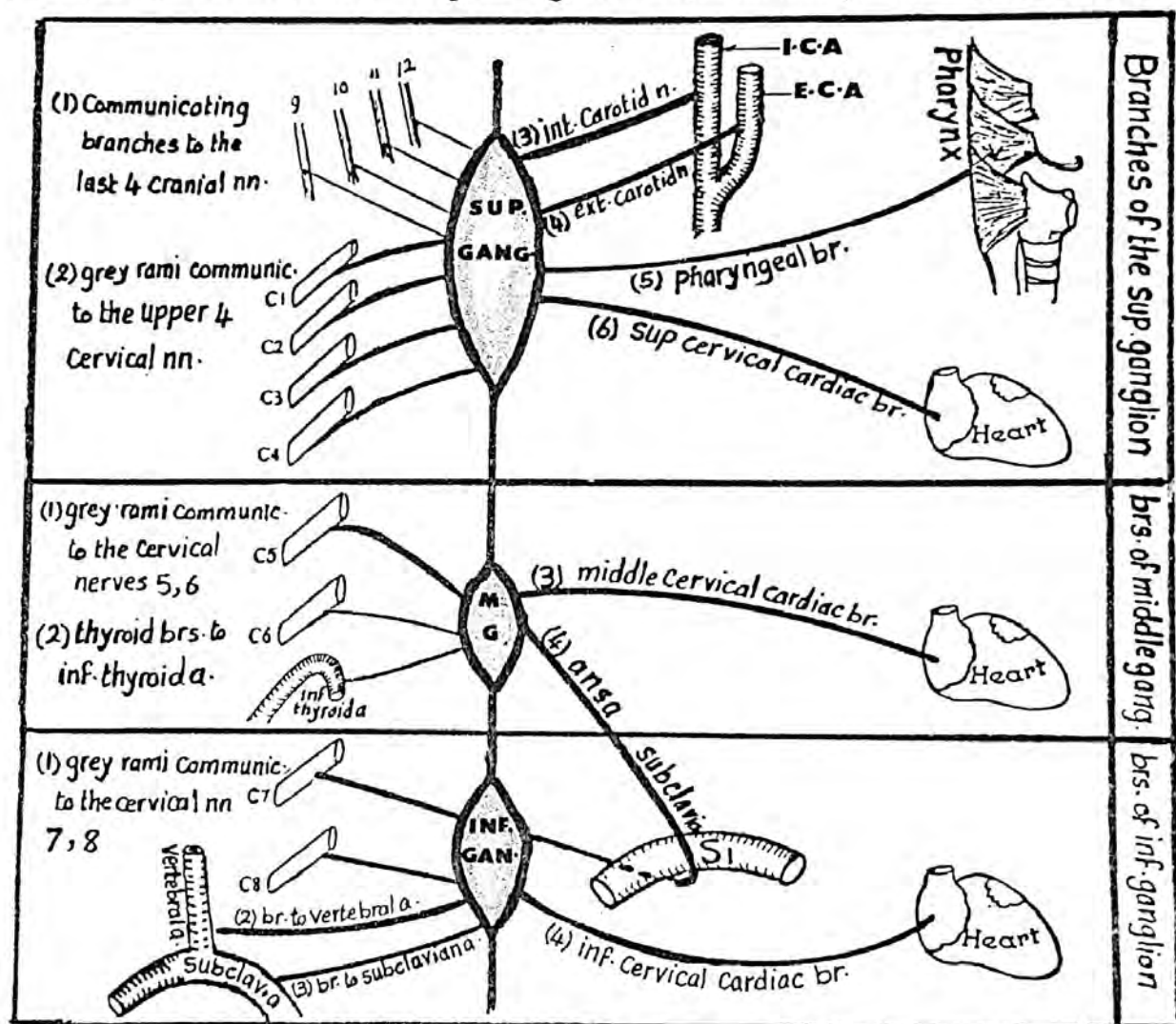
* **Size** : larger than the middle ganglion. It may fuse with the 1st thoracic ganglion to form the elongated cervico-thoracic (stellate) ganglion.

* **Site** : between the tr. process of C7 & the neck of the 1st rib.

* **Relations** : anteriorly : Origin of the Vertebral a.
posteriorly : neck of first rib.

* **Branches** :

- (1) grey rami communicantes to the 7th & 8th cervical nerves.
- (2) branches to the vertebral a. forming vertebral plexus of symp. fibres around it.
- (3) branches to the subclavian a. " subclavian " " " " " " "
- (4) inf. Cervical Cardiac br. joining the deep cardiac plexus in the thorax.



PETROSAL NERVES

* These are autonomic nerves whose course is related to the petrous part of temporal bone

* **They include** :
 (1) deep petrosal n. (sympathetic) : see page 61
 (2) greater superficial petrosal n. (parasymp.) see page 140 & 61
 (3) lesser superficial petrosal n. (parasymp.) see page 142

* Boundaries :

- * in front : post. border of sternomastoid m.
- * behind : ant. border of trapezius m.
- * below : (the base) : middle $\frac{1}{3}$ of clavicle.
- * above : (the apex) : is the meeting of sternomastoid & trapezius muscles at the sup. nuchal line.

* Floor : Formed by the following muscles arranged from below upwards :

- (1) scalenus medius (2) levator scapulae (3) splenius capitis

N.B : these muscles are covered by the prevertebral fascia.

* Roof : formed by :

- (1) skin (2) superficial fascia (3) deep fascia

N.B : the superficial fascia contains :

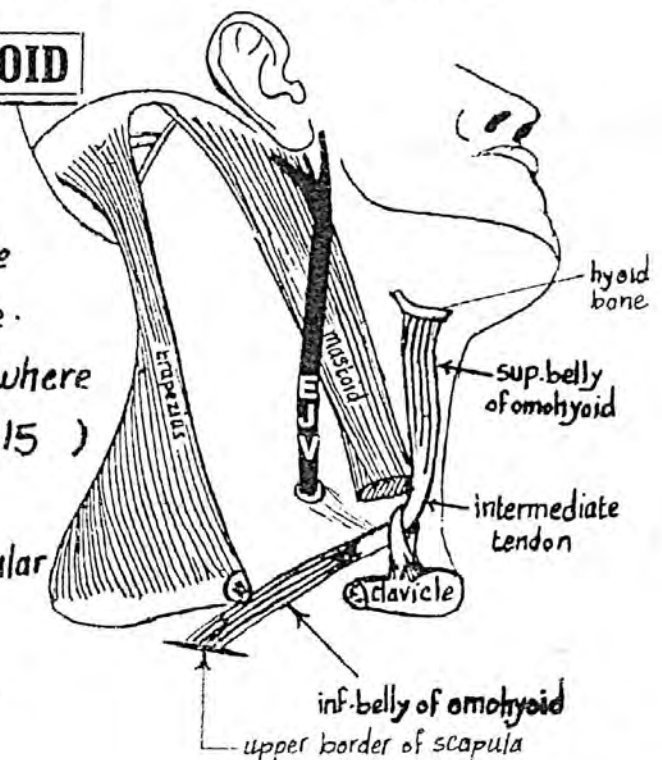
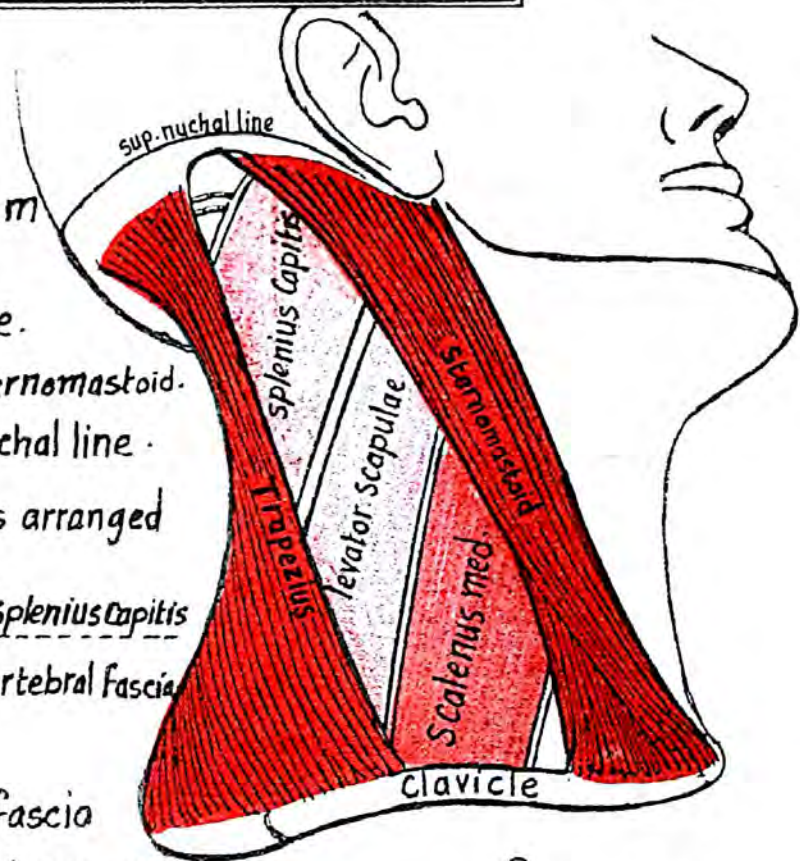
- (1) platysma m.
(2) Cutaneous branches of Cervical plexus
(3) Ext. Jugular v.

* Contents of the post. Δ :

- (1) one muscle : the inf. belly of omohyoid.
- (2) two sets of vessels : arteries & veins.
- (3) three sets of nerves : Accessory n., Brachial plexus & Cervical plexus.
- (4) Lymph nodes.

1- INF. BELLY OF OMOHYOID

- * it is a slender m. which arises from the upper border of scapula & suprascapular lig.
- * it runs forwards & upwards behind the clavicle crossing the post. Δ a little above the clavicle.
- * it disappears deep to the sternomastoid m where it joins the intermediate tendon (see page 115)
- * it divides the post Δ of neck into
 - (1) a very small Δ below it called the supraclavicular or subclavian triangle.
 - (2) a large Δ above it called the occipital Δ .



2- ARTERIES OF POST. TRIANGLE

152

(1) 3rd part of subclavian a. :

- * lies in the lower part of the post. Δ Close to the lower trunk of the brachial plexus
- * it extends from the lat. border of scalenus ant. to the outer border of 1st rib where it continues as axillary a.

(2) Suprascapular a. :

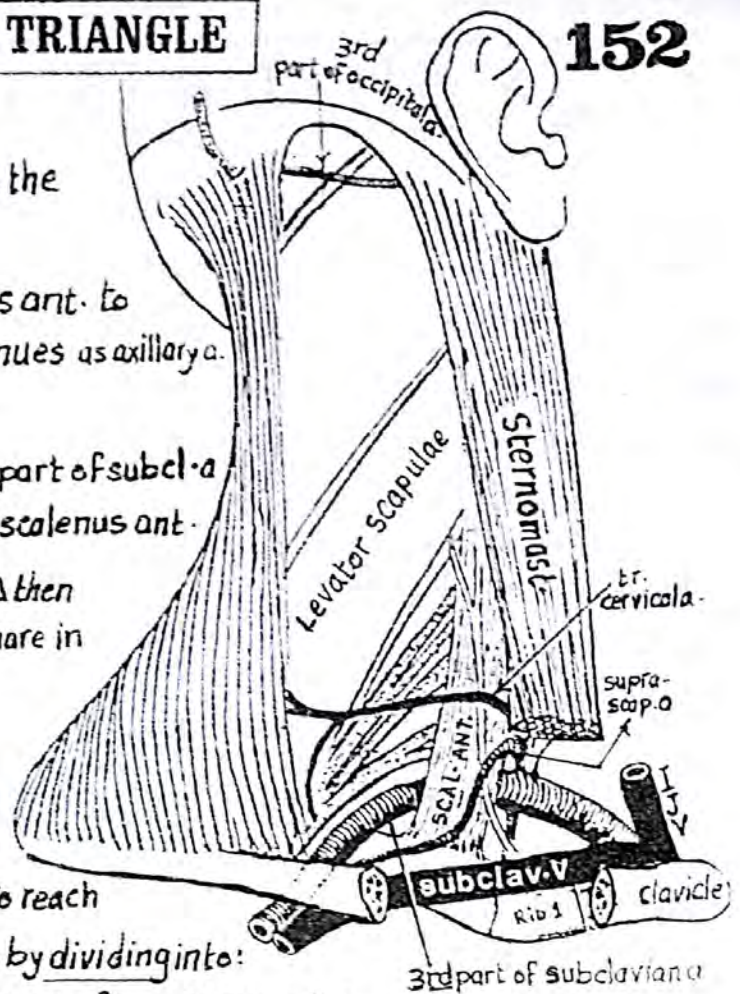
- * it is a branch of thyrocervical trunk of 1st part of subcl. a
- * it reaches the post. Δ by crossing in front of scalenus ant.
- * it passes laterally in the lower part of post. Δ then descends behind the clavicle (with its nerve) to share in the anastomosis around the scapula

(3) transverse cervical a. :

- * it is another br. of thyrocervical trunk which passes above the suprascapular a. to reach the post. Δ where it ends on levator scapulae by dividing into:
 - (a) superficial br. which ramifies on the deep surface of trapezius.
 - (b) deep br. which passes deep to levator scapulae then along med. border of scapula to share in the anastomosis around it.

(4) 3rd part of occipital a. : (br. of E.C.A)

crosses the apex of the post. Δ then disappears deep to the trapezius m.



3- VEINS OF POST. TRIANGLE

(1) Subclavian V. :

- * it lies in the lower most part of the post. Δ mostly behind the clavicle.
- * it begins at the outer border of the 1st rib as a continuation of the axillary v.
- * it crosses the upper surface of the 1st rib in front of the insertion of scalenus ant. which separates it from the subclavian a.
- * it ends behind the med. end of clavicle by joining the I.J.V to form the innominate v.
- * it has only one tributary : the ext. jugular v.

(2) Ext. jugular V. :

- * it descends in the superficial fascia to a point 1" above the clavicle where it pierces the deep fascia of the roof of post. Δ .
- * it descends in front of Brachial plexus to open into the subclavian v.
- * it has 3 tributaries: (1) ant. jugular v. (2) tr. cervical v. (3) suprascapular v.

4- NERVES OF POST. TRIANGLE

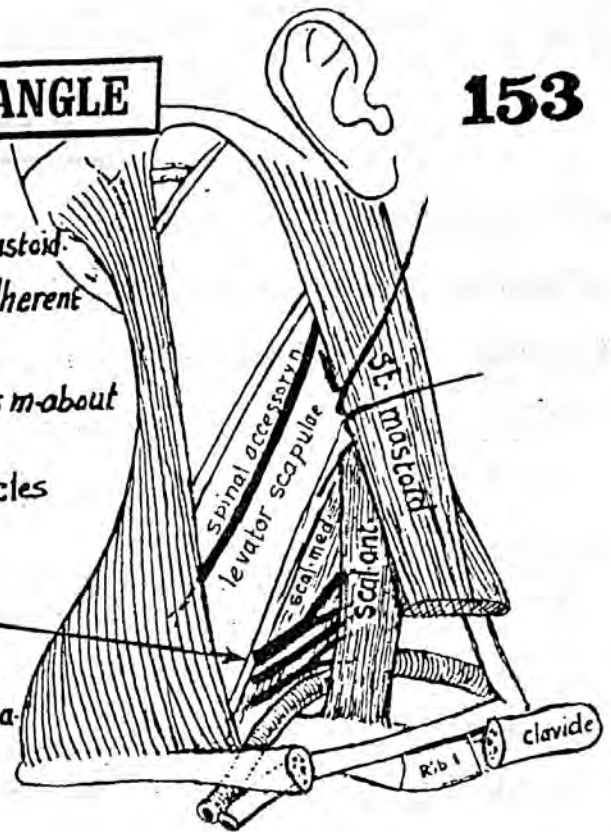
153

(1) Spinal accessory n.

- * it appears at the middle of post. border of sternomastoid.
- * it crosses the post. Δ over levator scapulae being adherent to the fascial roof of the Δ .
- * it disappears deep to the ant. border of trapezius m. about 5 cm. above the clavicle.
- * it supplies both sternomastoid & trapezius muscles

(2) Brachial plexus :

- * only the roots & the trunks of the plexus appear in the post. Δ between the scalenus ant. & scalenus medius m. above & behind the subclavian a.
- * the upper trunk gives 2 branches in the post. Δ :
(a) the suprascapular n. (b) n. to subclavius m.



(3) Cervical plexus : see page 98

its 4 cutaneous branches appear in the post. Δ about the middle of post. border of sternomastoid m.

(5) L. Nodes in the post. Δ

(1) occipital L. Ns : at the apex of the triangle alongside the occipital a.

(2) supraclavicular L. Ns : at the base of the triangle on the subclavian a.

THE SUBOCCIPITAL TRIANGLE

- * it is a triangular space lying deep to the apex of the post. Δ of neck & below the occipital bone

* Boundaries :

- 1- medially : rectus Capitis post. major & minor
- 2- above & laterally : obliquus Capitis superior
- 3- below & laterally : obliquus Capitis inferior

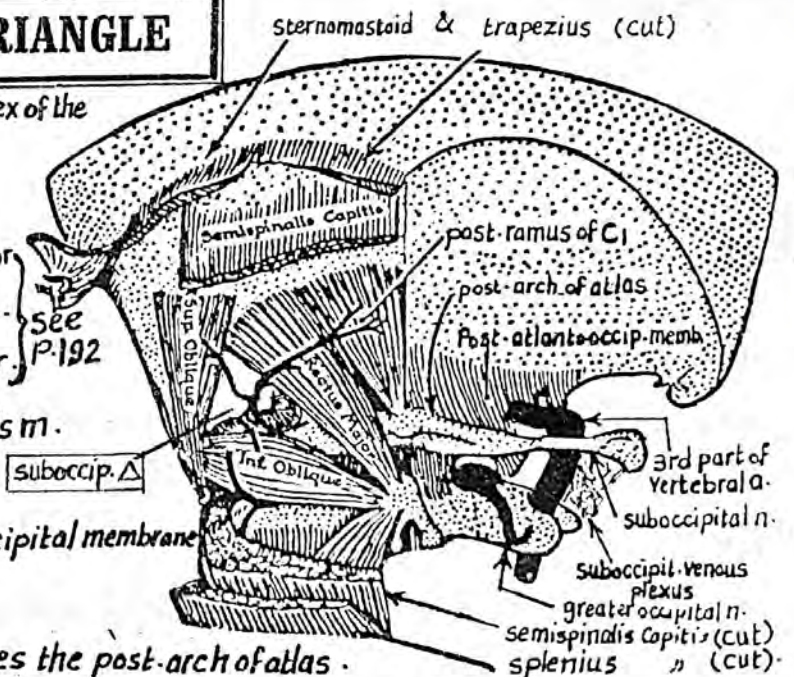
* **Roof** : formed by semispinalis Capitis m.

* **Floor** : formed by :

- (1) post. arch of atlas
- (2) post. atlanto-occipital membrane

* Contents :

- (1) 3rd part of vertebral a. as it grooves the post. arch of atlas.
- (2) suboccipital venous plexus : draining the ext. verteb. v. plexus, occipital vv. & emissary vv.
- (3) suboccipital n. (dorsal ramus of C_1) : appears between verteb. a. & the post. arch of atlas.
- (4) greater occipital n. (C_2) : appears below the inf. oblique m.
- (5) small occipital lymph node



* it is a muscular tube extending from the base of skull to the level of lower border of C6 vertebra.

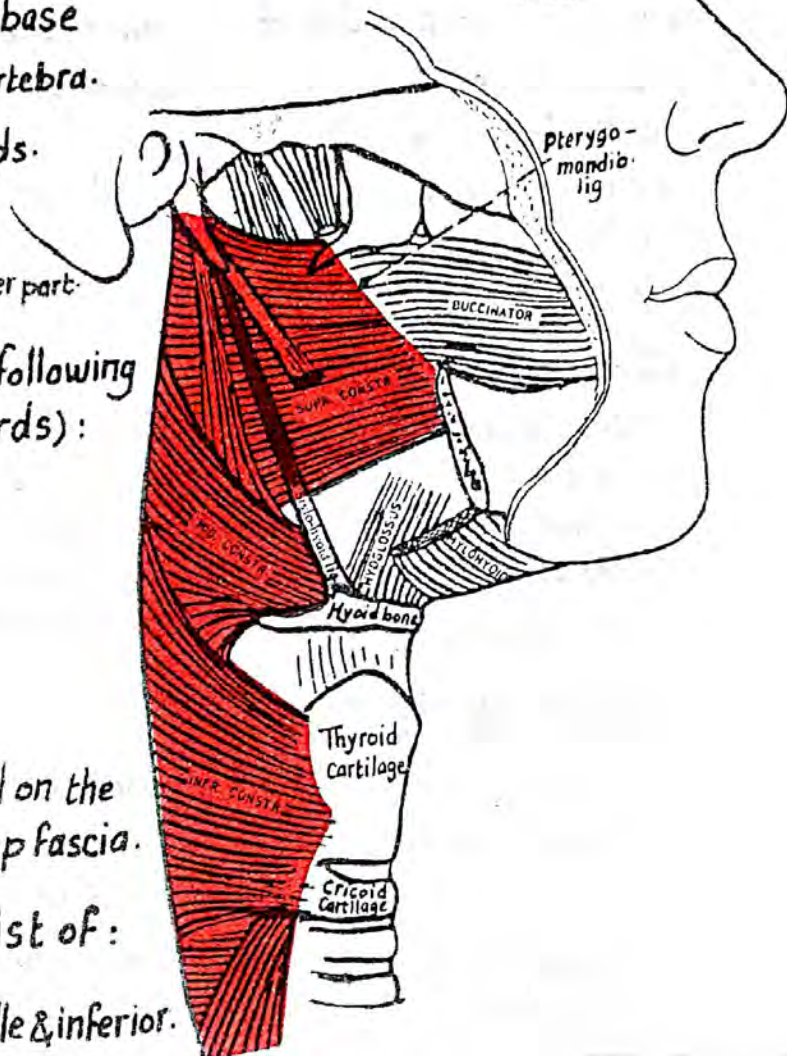
* **Shape** : Funnel-shaped with base upwards.

* **Size** : 5 inches long. Its diameter is one inch in the upper part & $\frac{1}{2}$ an inch in the lower part.

* **Structure** : its wall is formed of the following 5 layers (arranged from inside outwards) :

- (1) the mucous membrane.
- (2) submucous coat.
- (3) the pharyngea-basilar fascia.
- (4) the pharyngeal muscles.
- (5) bucco-pharyngeal fascia.

N.B : the pharyngeal muscles are covered on the outer & inner surfaces by sheets of deep fascia.



THE PHARYNGEAL MUSCLES consist of :

- (A) 3 Constrictor muscles : sup., middle & inferior.
- (B) 3 other muscles

CONSTRICOR MUSCLES OF PHARYNX

- SUP. Constrictor
- middle "
- inferior "

* They are 3 Curved muscular sheets overlapping each other.

* **Origin** : they arise separately from bones, cartilages & ligaments in the front of neck as follows :

(1) the superior Constrictor m. :

arises from the pterygomandibular lig. & the 2 bones to which it is attached : the pterygoid hamulus & the post. end of mylohyoid line of the mandible.

(2) the middle Constrictor m. :

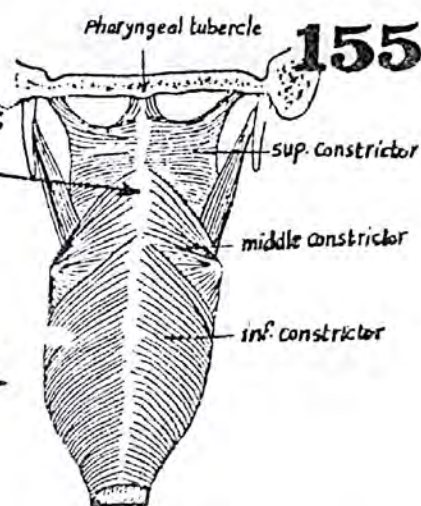
arises from the lower part of the stylohyoid ligament & the 2 horns of the hyoid bone.

(3) the inferior Constrictor m. :

arises along a line extending from the upper border of the thyroid cartilage to the lower border of cricoid cartilage of the larynx.

* Insertion of the Constrictor muscles :

the muscle fibres of the 3 Constrictors curve backwards and medially to be inserted into fibrous median raphe extending from the pharyngeal tubercle of base of skull to the cricoid Cartilage below.



(B) The 3 other muscles of Pharynx

(1) Stylopharyngeus m. :

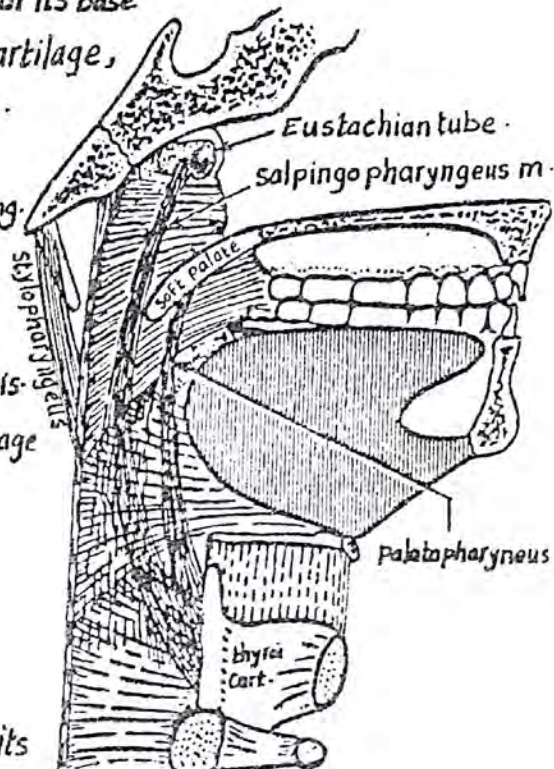
- * arises from the med. aspect of the styloid process near its base
- * inserted into the post. border of the lamina of thyroid Cartilage, some fibres are dispersed within the sup. constrictor m.
- * N. supply : glossopharyngeal n.
- * Action : elevates the pharynx & larynx during swallowing.

(2) Palatopharyngeus m. :

- * arises : from lower surface of the palatine aponeurosis
- * inserted into post. border of the lamina of thyroid Cartilage & into the pharyngeal wall.
- * N. supply : from the pharyngeal plexus of nerves.
- * Action : like stylopharyngeus m.

(3) Salpingopharyngeus m. :

- * arises from the inf. surface of the Eustachian tube near its pharyngeal opening.
- * inserted with palatopharyngeus into post. border of lamina of thyroid Cartilage
- * n. supply & action : like palatopharyngeus + it helps to keep the Eustachian tube patent.

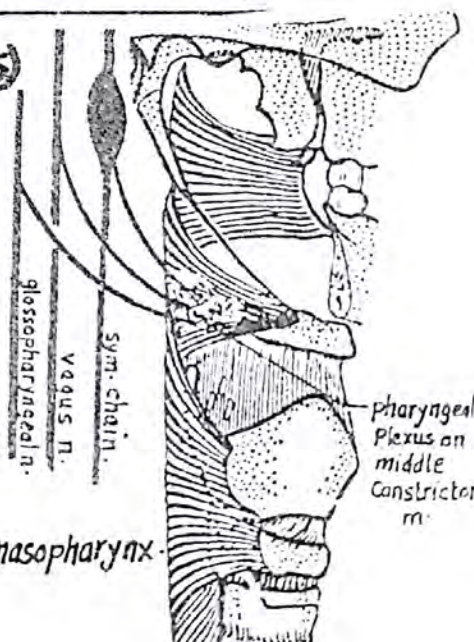


* N. Supply of Pharynx (the pharyngeal plexus)

- site : on the outer surface of middle constrictor m.
- nerves forming the plexus :

- (1) pharyngeal br. of vagus : motor & parasympathetic
- (2) pharyngeal br. of glossoph. n : sensory.
- (3) pharyngeal br. of sup. cervical symp. ganglion : sympathetic

- N.B : (a) the glossopharyngeal n. supplies the stylopharyngeus m.
 (b) the recurrent laryn. n. gives twig to the inf. constrictor m.
 (c) the pharyngeal br. of sphenopalatine ganglion supplies nasopharynx.



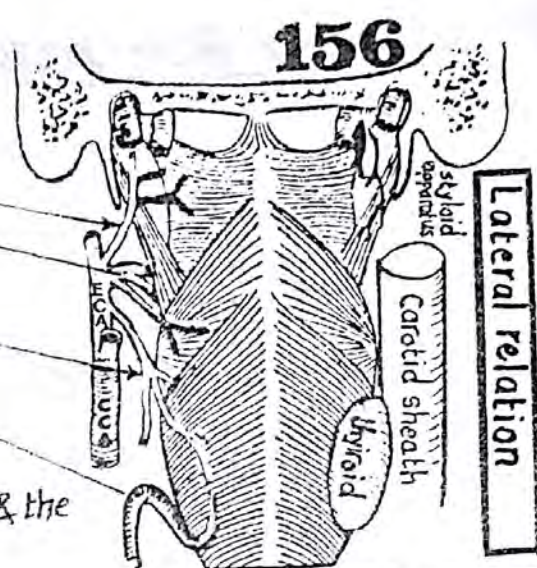
* Arterial Supply of pharynx :

- (1) the ascending pharyngeal br. of E.C.A.
- (2) tonsillar & ascending palatine brs. of facial a.
- (3) pharyngeal branches of sup. thyroid a.
- (4) " " " inf. thyroid a.

* Venous drainage :

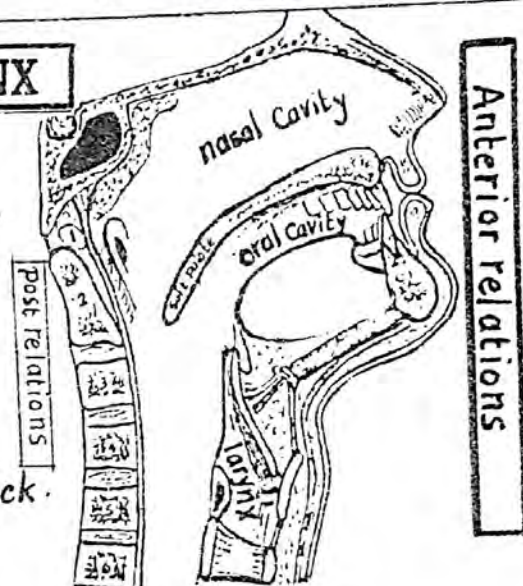
into the pharyngeal plexus of veins, facial V. & the I.V.C.

* Lymphatic drainage : into the retropharyngeal & the deep cervical L.Ns.



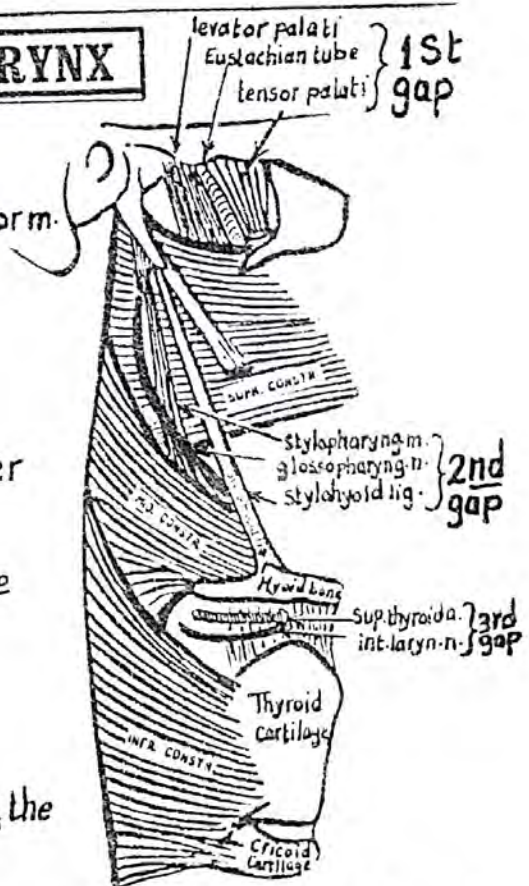
RELATIONS OF THE PHARYNX

- * Superior relations : base of skull
- * post. relations : bodies of the upper 6 cervical vertebrae.
- * Ant. relations : (1) nasal cavity
(2) oral cavity
(3) larynx
- * on each side
 - (1) Carotid sheath & the great vessels & nerves of the neck.
 - (2) Styloid process & structures attached to it.
 - (3) lat. lobe of the thyroid gland.



GAPS IN THE LAT. WALL OF PHARYNX

- (1) First gap :
 - lies between base of skull & the upper border of sup. constrictor m.
 - it is occupied by : tensor palati m., levator palati m. & the Eustachian tube (hidden in between the 2 muscles).
- (2) Second gap :
 - lies between lower border of sup. constrictor & the upper border of middle constrictor m.
 - it contains : stylohyoid lig., stylopharyngeus m. & the glossopharyngeal n.
- (3) Third gap :
 - lies between the lower border of middle constrictor & the upper border of inf. constrictor m.
 - it is traversed by internal laryngeal n. & sup. laryngeal a. (they pierce the thyrohyoid memb.)

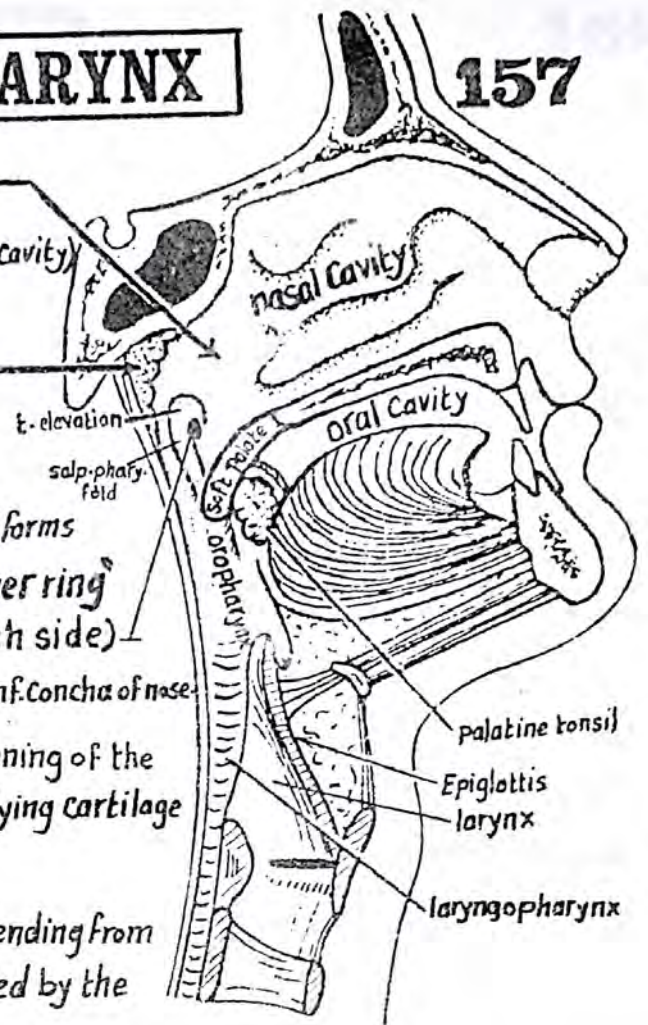


I- NASOPHARYNX:

* it is the upper part of the pharynx (behind nasal cavity)

* It Shows the following features:

- (1) Nasopharyngeal tonsil (adenoids) - it is a collection of lymphoid tissue beneath the epithelium of roof & post. wall of the nasopharynx. - Together with the palatine tonsils & lingual tonsils, it forms a continuous ring of lymphoid tissue called **Waldeyer ring**
- (2) Opening of the Eustachian tube (one on each side) - lies on the side wall of nasopharynx at the level of inf. Concha of nose.
- (3) Tubal elevation: the upper & post. lips of the opening of the Eustachian tube are prominent (due to the underlying cartilage of the tube) forming the tubal elevation.
- (4) Salpingo-pharyngeal fold: a vertical fold descending from the lower part of the tubal elevation. It is produced by the salpingopharyngeus m.
- (5) Pharyngeal recess: a narrow space behind the salpingopharyngeal fold.



* Communications of nasopharynx: it communicates with:

- (1) nasal cavity in front through the post. nasal openings.
- (2) tympanic cavity on each side through the Eustachian (pharyngotympanic) tube.
- (3) oropharynx below through the pharyngeal isthmus (lying between the post. border of the soft palate & the post. wall of the pharynx).

II- OROPHARYNX:

- * it is the part of the pharynx lying behind the oral cavity.
- * it extends from the soft palate above to the upper border of the epiglottis below
- * it communicates anteriorly with the oral cavity through the oropharyngeal isthmus bounded on each side by the palatoglossal arches.
- * the lat. wall of the oropharynx presents a palatine tonsil (one on each side).

- The Palatine tonsil:

- * Structure: it is a mass of lymphoid tissue incompletely surrounded by capsule.
- * Shape: almond-shaped.

* **Site** : it lies in the tonsillar fossa on the lat. wall of oropharynx. This fossa is bounded anteriorly by the palatoglossal arch (fold) & bounded posteriorly by the palatopharyngeal arch (fold).

N.B : each arch is formed by a muscle (having the same name) & covered by mucous memb.

* **Surfaces** : it has 2 surfaces :

- (1) lat. surface : related to sup. constrictor m.
- (2) med. surface : free surface presenting 12-15 tonsillar crypts.

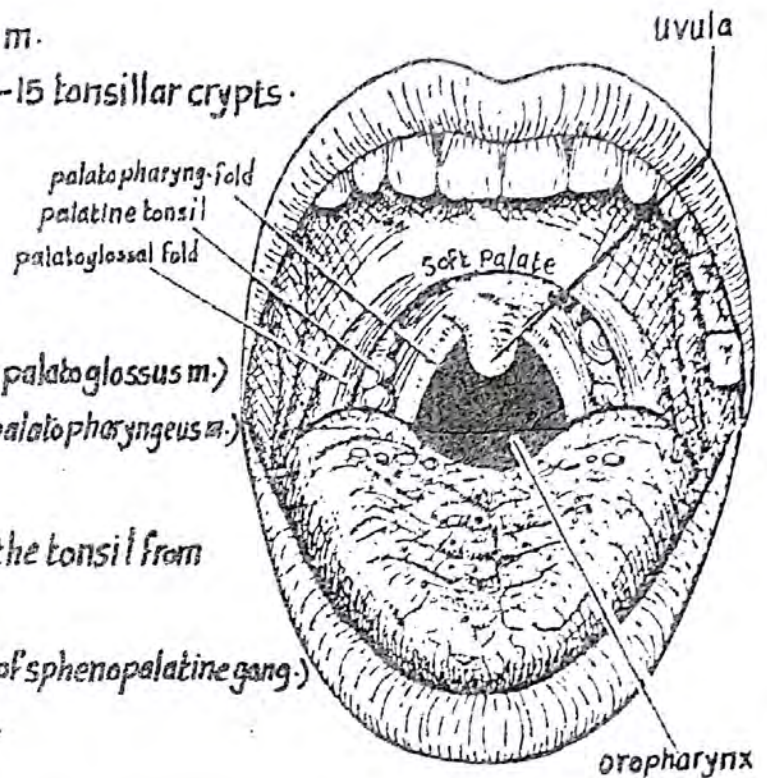
* **Relations** :

- (1) superiorly : soft palate.
- (2) inferiorly : dorsum of tongue.
- (3) anteriorly : palatoglossal fold (containing palatoglossus m.)
- (4) posteriorly : palatopharyngeal fold (palatopharyngeus m.)
- (5) medially : free surface
- (6) laterally : sup. constrictor m. separating the tonsil from the facial a.

* **Nerve supply** : (1) lesser palatine n. (br. of sphenopalatine gang.)
(2) glossopharyngeal n.

* **Arterial supply** :

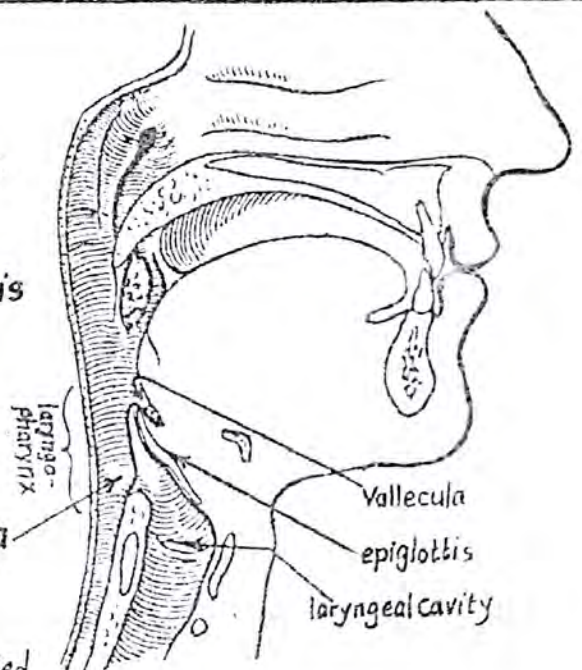
- (1) tonsillar br. of facial a. (the main a.) : enters the lat. surface of the tonsil near its lower pole.
- (2) tonsillar branches of ascending pharyngeal a., ascending palatine a. & greater palatine a.



III- LARYNGOPHARYNX :

- * it is the lowermost part of the pharynx which lies behind the larynx.
- * it extends from the level of upper border of epiglottis above to the lower border of cricoid cartilage below
- * its ant. wall is formed mainly by the laryngeal orifice
- * its lat. wall shows a depressed area on either side of the laryngeal orifice called the piriform fossa
- * it is continuous below with the oesophagus.

N.B : the recess between the tongue & the epiglottis is called the vallecula.



LARYNX

159

*It is the organ of voice & acts also as an air passage.

* **Site** : it projects forwards in the median region of the neck extending from the root of tongue to the trachea (from the middle of C₃ vertebra to the lower border of C₆ vertebra).

* **Relations** :

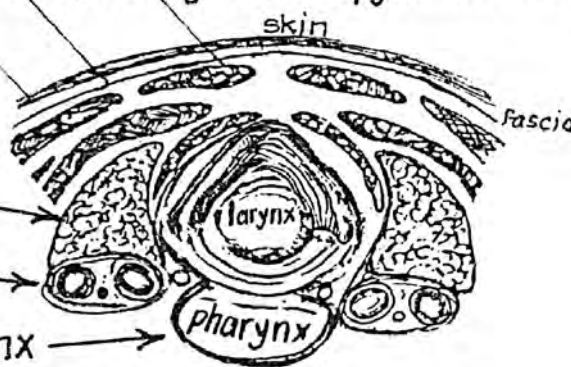
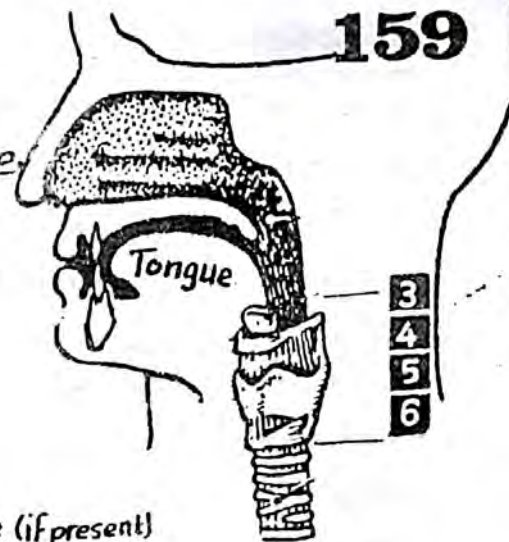
(1) anteriorly : skin, fascia, infrahyoid mm & pyramidal lobe (if present)

(2) on each side :

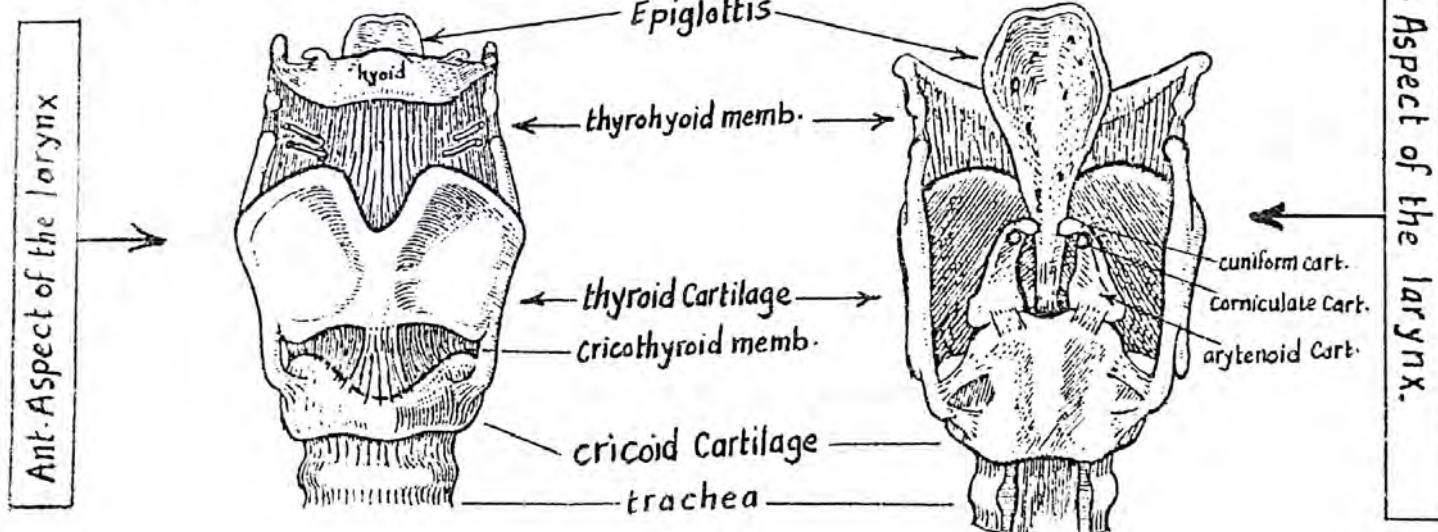
(a) lat. lobe of thyroid

(b) Carotid sheath

(3) posteriorly : pharynx



* Structure of the larynx :



The larynx is formed by a number of cartilages which are connected together by ligaments & membranes and lined by mucous memb. & moved by a number of muscles.

CARTILAGES OF THE LARYNX

single

- (1) Epiglottis
- (2) Thyroid Cartilage
- (3) Cricoid Cartilage

paired

- arytenoid cartilages
 Corniculate "
 cuneiform "

(1) Epiglottis :

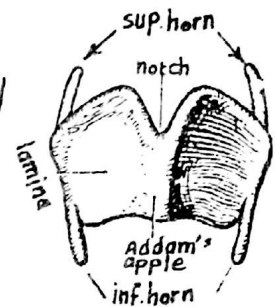
- * it is a leaf-like lamella of elastic cartilage.
- * it projects upwards behind the tongue & the hyoid bone.
- * its upper end is wide & free.
- * its lower end is narrow & fixed to the inner aspect of the thyroid prominence.



160

(2) Thyroid Cartilage :

- * It is formed of 2 laminae which are separated posteriorly but united anteriorly to form the laryngeal prominence (Adam's apple).
- * the angle between the 2 laminae is 90° in males and 120° in females.
- * the post. border of each lamina has 2 horns :



(a) sup. horn : attached to the greater horn of hyoid bone by the lat. thyrohyoid lig.

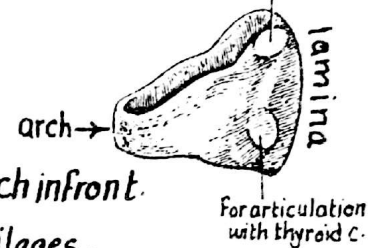
(b) inf. horn : articulates with cricoid cartilage at the crico-thyroid joint.

- * the lat. surface of the lamina shows an oblique line.

For articulation with cricoid c.

(3) Cricoid Cartilage : (below thyroid cartilage).

- * is ring-shaped having a broad lamina posteriorly & a narrow arch in front.
- * the upper border of the lamina articulates with the arytenoid cartilages.
- * the anterolat. aspect of the arch articulates with the inf. horn of the thyroid cartilage.

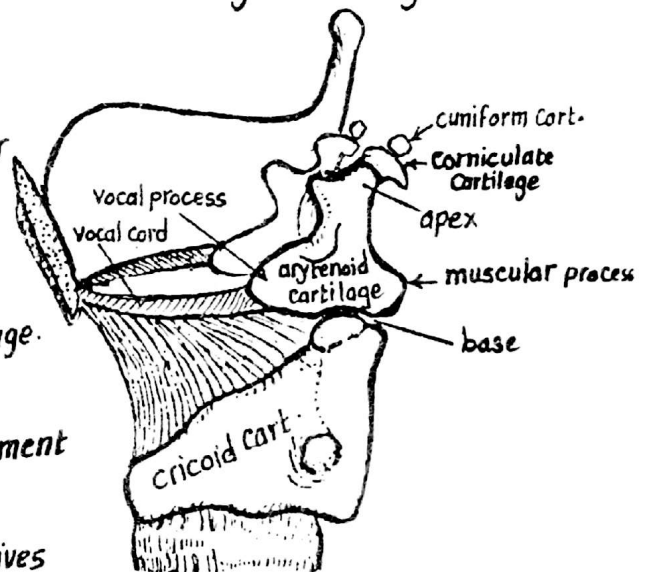


(4) Arytenoid Cartilages : (Rt. & Lt.).

- * each one articulates with the upper border of the lamina of cricoid cartilage.
- * each one is pyramidal in shape having :

- (1) apex (above) : articulates with corniculate cartilage.
- (2) base (below) : articulates with cricoid cartilage.
- (3) vocal process : directed forwards & gives attachment to the vocal lig. (cord).
- (4) muscular process : directed posterolaterally & gives

insertion to the muscles which move the arytenoid cartilage.



(5) Corniculate Cartilages : (Rt. & Lt.) :

each one is a small cartilage nodule lying on the apex of the arytenoid cartilage.

(6) Cuneiform Cartilages : (Rt. & Lt.) :

each one is a small cartilage nodule lying in front of the corniculate cartilage in the aryepiglottic fold.

(1) Thyrohyoid membrane :

- attached above to the deep surface of hyoid bone near its lower border.
- attached below to the upper margin of the thyroid cartilage.
- it is pierced by : internal laryngeal n. & sup. laryngeal a.

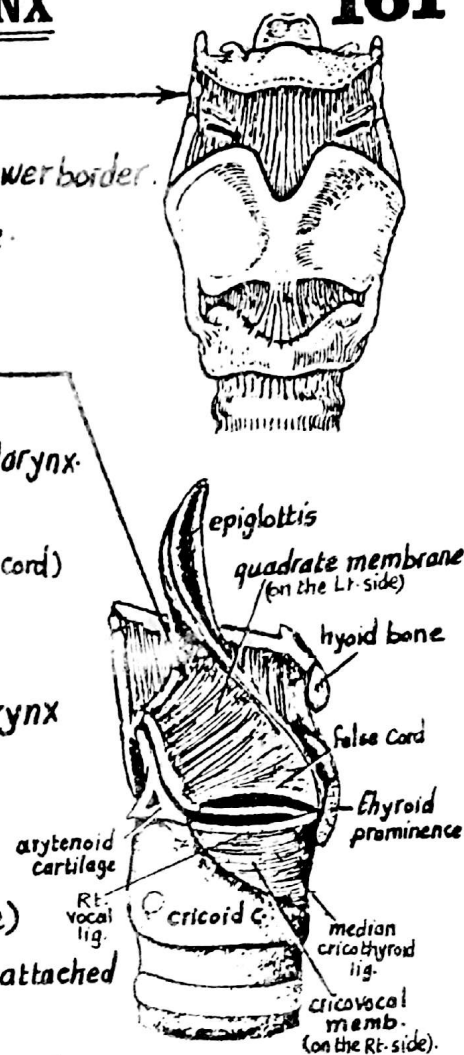
(2) The quadrate membrane :

- it is the upper part of the fibro-elastic memb. which lines the larynx.
- it extends between the arytenoid cartilage & the epiglottis
- its lower border is thickened to form the vestibular fold (false cord)

(3) Cricothyroid membrane & lig. :

- it is the lower part of the fibroelastic memb. lining the larynx
- it connects the thyroid, cricoid & arytenoid cartilages.
- the ant. median part of this memb. is called the median cricothyroid lig
- the lat. part of the cricothyroid membrane (on each side) is triangular & called the cricovocal membrane which is attached below to the upper border of cricoid cartilage
- the upper border of the cricovocal memb. is attached anteriorly to the inner aspect of thyroid prominence & attached posteriorly to the vocal process of arytenoid cartilage. this upper border is called the **Vocal lig.** (true vocal cord).

N.B. : the vocal cord is formed by a vocal lig. covered by mucous memb.



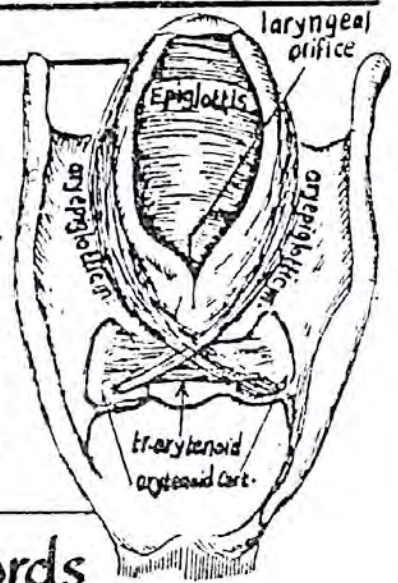
MUSCLES OF THE LARYNX

* General rules :

- (1) they are intrinsic muscles i.e have no attachment outside the laryngeal cartilages.
- (2) all of them are present inside the larynx except one : the cricothyroid (lies outside).
- (3) all of them are supplied by the recurrent laryngeal n. except the cricothyroid which is supplied by the external laryngeal n.
- (4) according to their action they are divided into 5 groups :
 - (a) muscles which close the laryngeal orifice.
 - (b) muscles which stretch the vocal cords.
 - (c) " " relax " " "
 - (d) " " abduct " " "
 - (e) " " adduct " " "

(A) Muscles which close laryngeal orifice 162

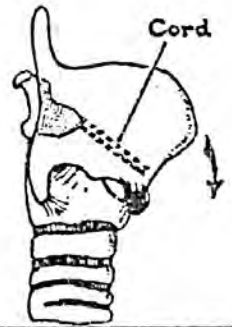
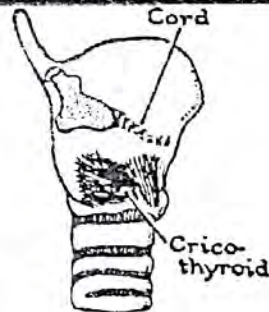
MUSCLE	ACTION
(1) transverse Arytenoids	draws the 2 arytenoid Cartilages close to each other.
(2) 2 Ary-Epiglottic muscles	they encircle the laryngeal orifice acting like a sphincter. Their contraction draws the 2 arytenoid Cartilages to each other & draws the epiglottis towards arytenoids to close the laryngeal orifice



(B) Muscles which stretch Vocal Cords

* The 2 Cricothyroid muscles :

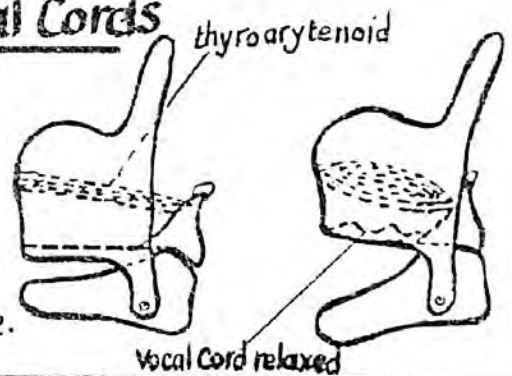
they act by lowering the thyroid cartilage forwards so that the distance between the vocal process of arytenoid & the laryngeal prominence is increased & the vocal cords become stretched.



(C) Muscles which relax vocal Cords

* The 2 thro-arytenoid muscles :

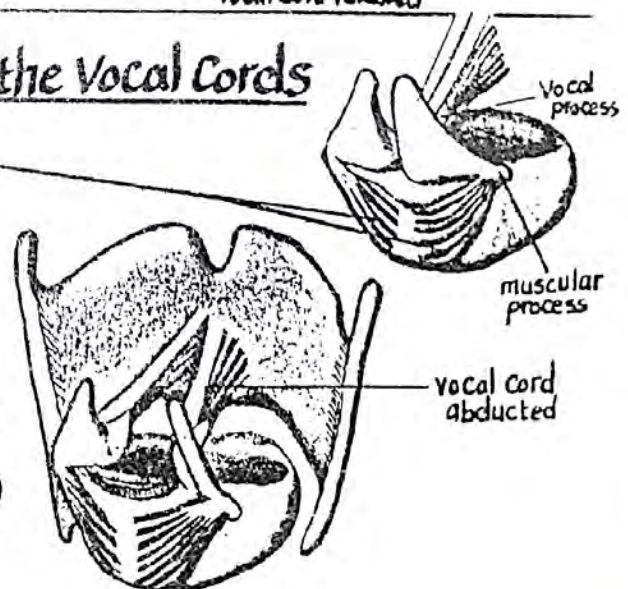
they relax the cords by pulling the arytenoid Cartilages forwards towards the laryngeal prominence. Each muscle stretches between the arytenoid cartilage & the back of Adam's apple.



(D) Muscles which abduct the Vocal Cords

* The 2 post. crico-arytenoids

they draw the muscular processes of the arytenoid Cartilages backwards so that the vocal processes become directed laterally & the vocal cords are thus widely separated and the space between them (rima glottidis) becomes wider.



-
- A black and white line drawing of a hand holding a fork, poised to eat from a bowl. The bowl contains a textured substance, possibly food. The drawing is simple and illustrative.

(2) The 2 lat. crico-arytenoid muscles:

* the cavity of the larynx is divided into 3 compartments by 2 pairs of Folds which extend from before backwards:

- (1) upper folds called Vestibular folds (false vocal cords)

- (2) lower folds called Vocal folds (true vocal cords).

* Compartments of the larynx:

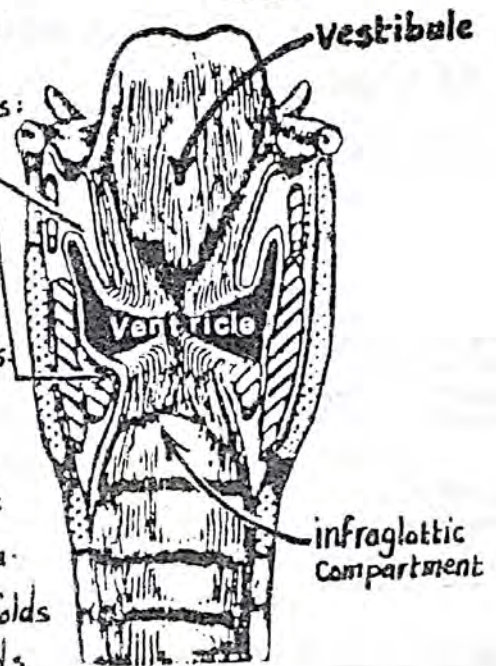
- (1) Vestibule (upper compartment): above the vestibular folds.

- (2) Ventricle or sinus of larynx (middle compartment):
between the vestibular folds above & the vocal folds below.

- (3) infraglottic Compartment: (lower compartment) lies below the vocal folds & is continuous below with the trachea.

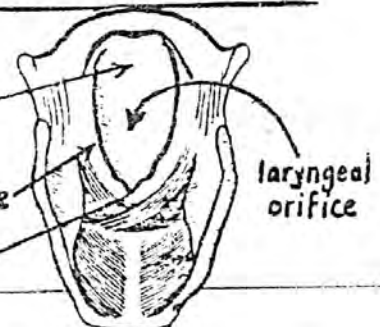
* N.B (1) rima vestibuli : is the space between the 2 vestibular folds

- (2) rima glottidis: " " " " " " Vocal folds



* it is bounded by:

- (1) the epiglottis : above & in front
- (2) 2 aryepiglottic folds (containing aryepiglottic m) on each side
- (3) interarytenoid fold (containing tr. arytenoid m) below & behind



* Arterial Supply of larynx: (1) sup. laryngeal a. (br. of sup. thyroid a.)

- (2) inf. laryngeal a. (" " inf. " ").

* Venous drainage :

- Veinous drainage -
- (1) veins of the upper part of larynx join the sup. thyroid v. which ends in the I.J.V.
 - (2) " " " lower " " " " " " " " " " innominate v.

* Lymphatic drainage of larynx:

- * Lymphatic drainage of larynx
- (1) lymphatics of the vocal cords & upper part of larynx drain into the upper deep cervical L.Ns.
- (2) " " lower part drain into the lower deep cervical L.Ns & prelaryngeal L.Ns.

NERVE SUPPLY OF THE LARYNX

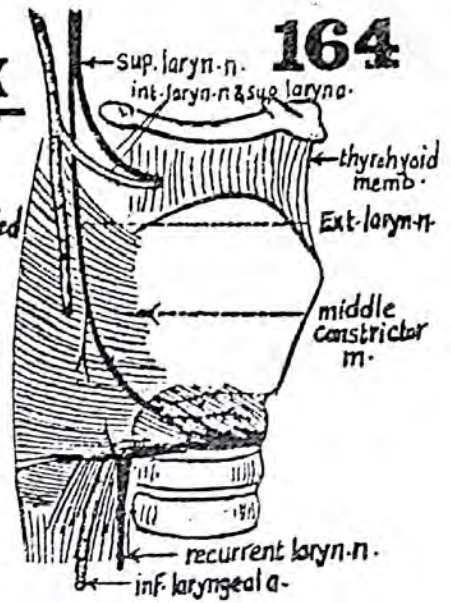
164

(1) Motor supply of the laryngeal muscles

- * All the laryngeal muscles (except cricothyroid m.) are supplied by the recurrent laryngeal nerves (branches of vagi).
- * the cricothyroid m. is supplied by the external laryngeal n. (br. of sup. laryngeal n. from vagus).

(2) Sensory supply of the mucous membrane :

- * the mucous memb. above the vocal cords is supplied by the int. laryngeal n. (br. of sup. laryngeal n. of vagus).
- * the mucous memb. below the vocal cords is supplied by the recurrent laryn. n. (br. of vagus).



N.B For details of the nerves supplying the larynx see page : 144 .

CERVICAL PART OF TRACHEA

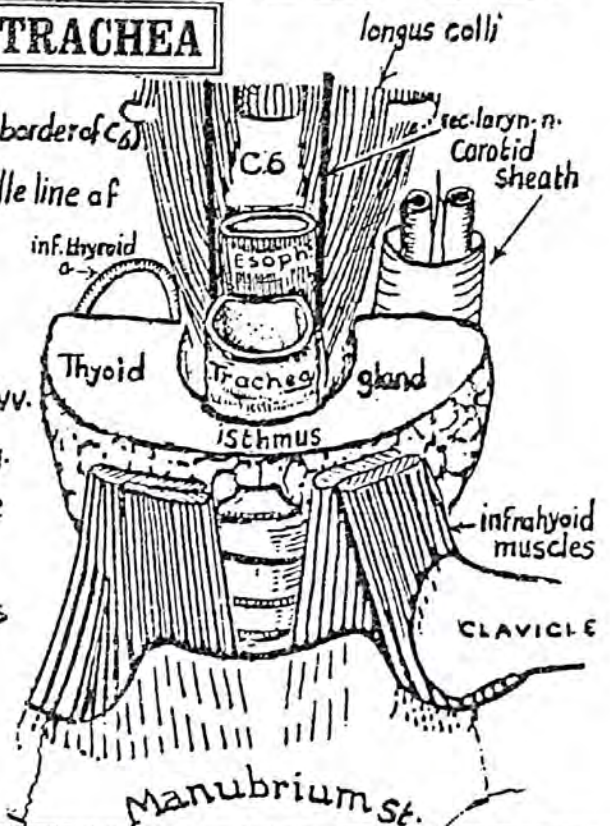
* Begins : as a continuation of the larynx (at the lower border of C₆)

* Course : it descends vertically downwards in the middle line of neck in front of the oesophagus .

* Relations :

- (1) Anteriorly :
 - (a) skin, fascia & ant. jug. veins .
 - (b) infrahyoid muscles .
 - (c) isthmus of thyroid gl. & inf. thyroid vv.
- (2) Posteriorly : the oesophagus with recurrent laryn. nerves in the R. & L. grooves between the trachea & the oesophagus .
- (3) on each side :
 - (1) Carotid sheath & its contents
 - (2) lat. lobe of thyroid gland .
 - (3) inf. thyroid a.

* Blood supply : inf. thyroid vessels .



CERVICAL PART OF OESOPHAGUS

* Begins : as a continuation of the pharynx (at the lower border of C₆) .

* Course : descends vertically downwards in the middle line of neck in front of vert. column .

* Anterior relations : trachea & recurrent laryngeal nerves .

* posterior relations : the cervical vertebrae, longus colli m. & prevertebral fascia .

* lateral relations : Carotid sheath, lat. lobe of thyroid gland, inf. thyroid a. & thoracic duct (on the Lt. side) .

* Blood supply : inf. thyroid vessels .

ORAL CAVITY

It is divided into 2 parts : vestibule & mouth proper.

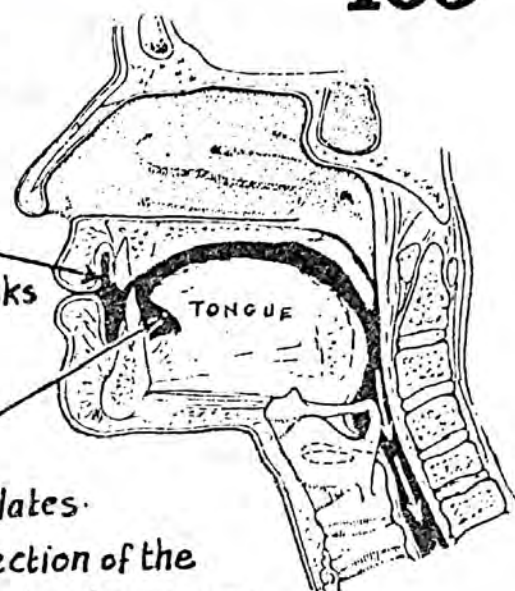
(1) The Vestibule of the mouth (labial Cavity) :

it is a narrow cleft-like space between the lips & cheeks (externally) and the gums (internally).

(2) The Cavity of the mouth proper (buccal Cavity)

- its roof : is formed by both the hard & the soft palates.
- its floor : is formed mainly by the tongue & the reflection of the mucous memb. from its sides to the gums. Below this mucous memb. lie the sublingual salivary glands & mylohyoid m.
- its sides : are formed by the dental arches carrying the teeth.

N.B : the buccal Cavity communicates posteriorly with the oropharynx through the "oropharyngeal isthmus"



THE TONGUE

* Structure : it is a muscular organ formed of mass of muscles Covered by an envelope of mucous membrane.

* Site : it lies on the floor of the oral Cavity Filling it almost Completely.

* parts of the tongue :

(1) root : it is the post. part through which pass the muscles connecting the tongue to the hyoid bone & mandible.

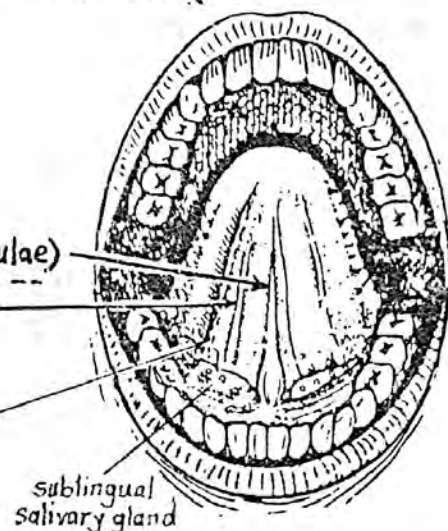
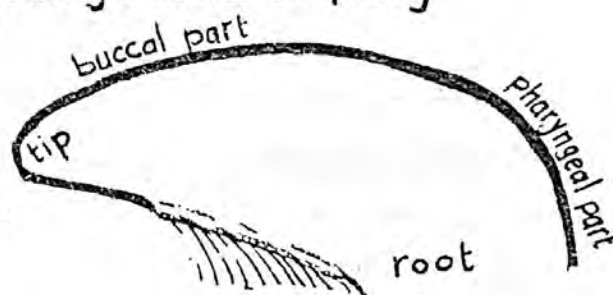
(2) tip & margins : lie opposite gums & teeth.

(3) lower surface : is related to the floor of mouth & is covered by a thin transparent mucosa & Shows :

(a) a raised fold of mucosa in the middle line (frenulum lingulae)

(b) on each side of the middle line, a deep lingual vein passes deep to the mucosa.

(c) lat. to the deep lingual v. there is the fimbriated fold which is a raised fold of mucosa having fimbria.

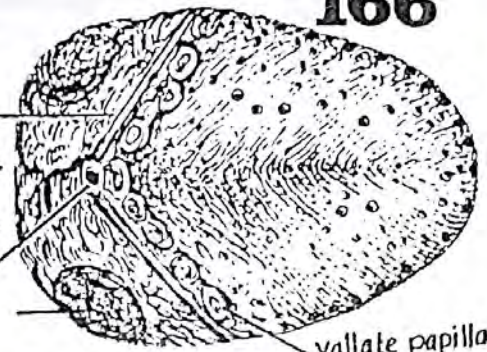


(4) Dorsum of tongue (upper surface):

- it is divided by a V-shaped groove (sulcus terminalis) into: ant. 2/3 (oral part) & post. 1/3 (pharyngeal part).
- the apex of this sulcus is directed posteriorly & presents a foramen called the foramen caecum

lingual tonsil

vallate papillae



	the ant. 2/3 of dorsum of tongue	the post. 1/3 of the dorsum of tongue
Name	Called palatine or buccal part	Called the pharyngeal part
position	looks upwards & can be seen from the mouth	looks backwards (forming the ant. wall of the oropharynx)
Papillae	(1) Filiform papillae: small & numerous (2) fungiform " : at the tip & margins (3) Vallate " : lying in front of the sulcus terminalis & full of taste buds.	NO Papillae
lingual tonsils	absent	present
Embryological origin	From the endoderm of the 1st pharyngeal arch	From the endoderm of the 3rd pharyngeal arch.
Nerve supply	2 nerves : (1) lingual n. : carries general sensations (2) chorda tympani : carries taste "	one nerve : the glossopharyngeal n. carries all sensations.

MUSCLES OF THE TONGUE

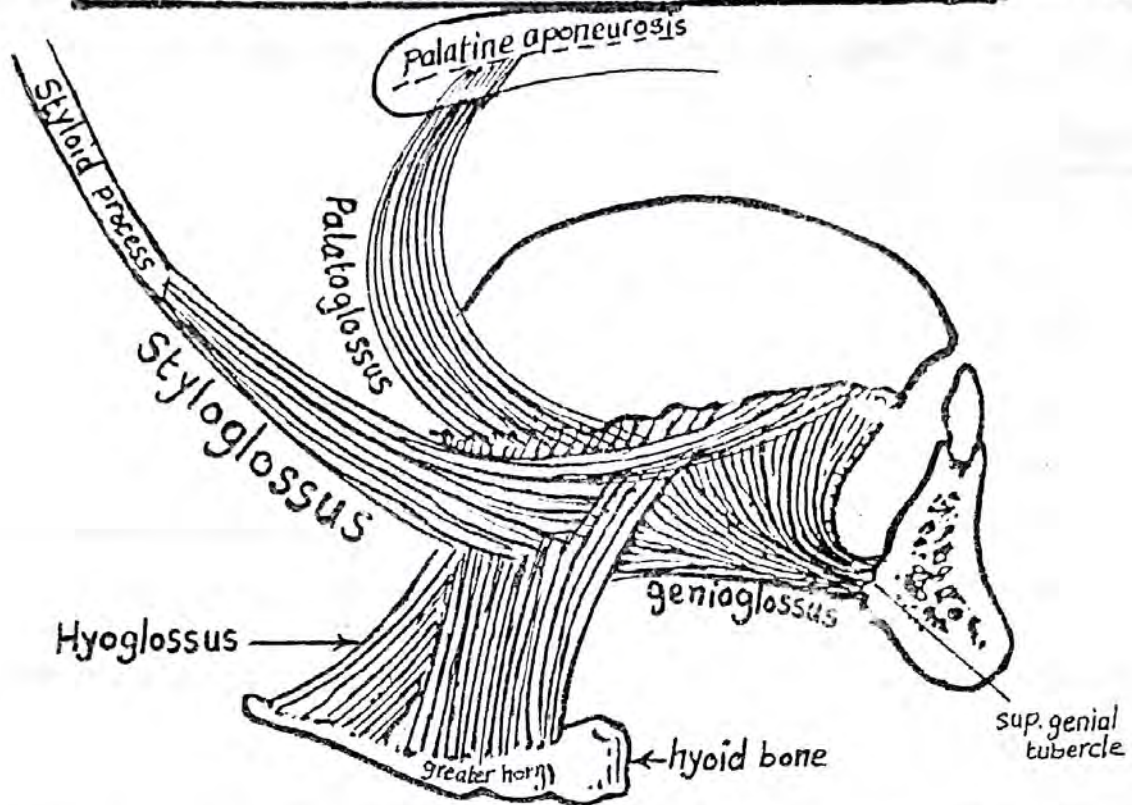
intrinsic muscles

- * they all lie inside the tongue & have no attachments outside the tongue.
- * they change the shape of the tongue
- * they include :
 - (1) vertical muscle fibres
 - (2) transverse " "
 - (3) sup. longitudinal m. fibres
 - (4) inf. longitudinal m. fibres
- * they are all supplied by hypoglossal n.

extrinsic muscles

- * they arise from the nearby bones & are inserted into the tongue.
- * they move the tongue & change its shape
- * they include :
 - (1) genioglossus m.
 - (2) hyoglossus m.
 - (3) styloglossus m.
 - (4) palatoglossus m.
- * they are all supplied by hypoglossal n. except the palatoglossus (supplied by vagus n.).

The Extrinsic muscles of the tongue 167



Muscle	Origin	Insertion	Action
1- Hyoglossus	upper border of greater horn & body of hyoid bone	post. $\frac{1}{2}$ of side of tongue	depresses the tongue
2- Styloglossus	tip of styloid process	whole length of side of tongue, decussating with hyoglossus m.	retracts the tongue backwards.
3- Palatoglossus	lower surface of palatine aponeurosis	post. $\frac{1}{3}$ of side of tongue	pulls the tongue upwards.
4- genioglossus	upper genial tubercle of mandible	whole length of the under-surface of the tongue	single m. pulls the tongue to the opposite side. The 2 muscles pull the tongue directly forwards.

NERVE SUPPLY OF THE TONGUE

(1) Motor Supply: hypoglossal n. supplies all muscles of the tongue except palatoglossus which is supplied by the cranial accessory n. (through Vagus).

(2) Sensory Supply:

(a) Ant. $\frac{2}{3}$ of the mucous membrane (1) the taste sensation is carried by Chorda tympani. (2) general sensations: carried by the lingual n.

(b) Post. $\frac{1}{3}$ of the mucous memb: all sensations are carried by the glossopharyngeal n.

* Arterial supply: lingual a. see page 132.

168

* Venous drainage: the lingual v. which drains into the I.J.V

* Lymphatic drainage:

(A) the ant. 2/3 of the tongue:

(1) the tip of the tongue drains into the submental L.Ns of both sides

(2) the margins of α drain into the submandibular L.Ns of the same side $\rightarrow$ to upper deep cervical L.Ns. of the same side.

(B) the post. 1/3 of tongue: drains into the upper deep cervical L.Ns of both sides.

THE PALATE

* it is a partition separating the nasal cavity above from the oral cavity below.

* it is formed of 2 parts:

(1) hard palate: a bony septum between nose & mouth.

(2) Soft palate: a fleshy septum between nasopharynx & oropharynx.

THE SOFT PALATE

* Functions:

(1) during respiration: the soft palate is relaxed allowing the passage of air.

(2) during swallowing: the soft palate is elevated & its post. border comes in firm contact with the post. wall of the pharynx thus preventing the food & fluids from regurgitating into nasopharynx.

* Structure of the soft palate: it is formed of: $\left\{ \begin{array}{l} \text{palatine aponeurosis} \\ \text{palatine muscles} \end{array} \right.$

(A) Palatine aponeurosis: it is the flattened expanded tendon of tensor palati m. which is attached to the post. border of the hard palate. This palatine aponeurosis gives attachment to all palatine muscles

(B) palatine muscles:

(1) Tensor palati m.:

* origin: from the scaphoid fossa of base of skull & from lat. surface of Eustachian tube.

* insertion: the muscle forms a rounded tendon which hooks around the pterygoid hamulus then expands to form the palatine aponeurosis which gains attachment to the post. border of the hard palate. The aponeuroses of the Rt. & Lt. muscles join each other in the median plane.

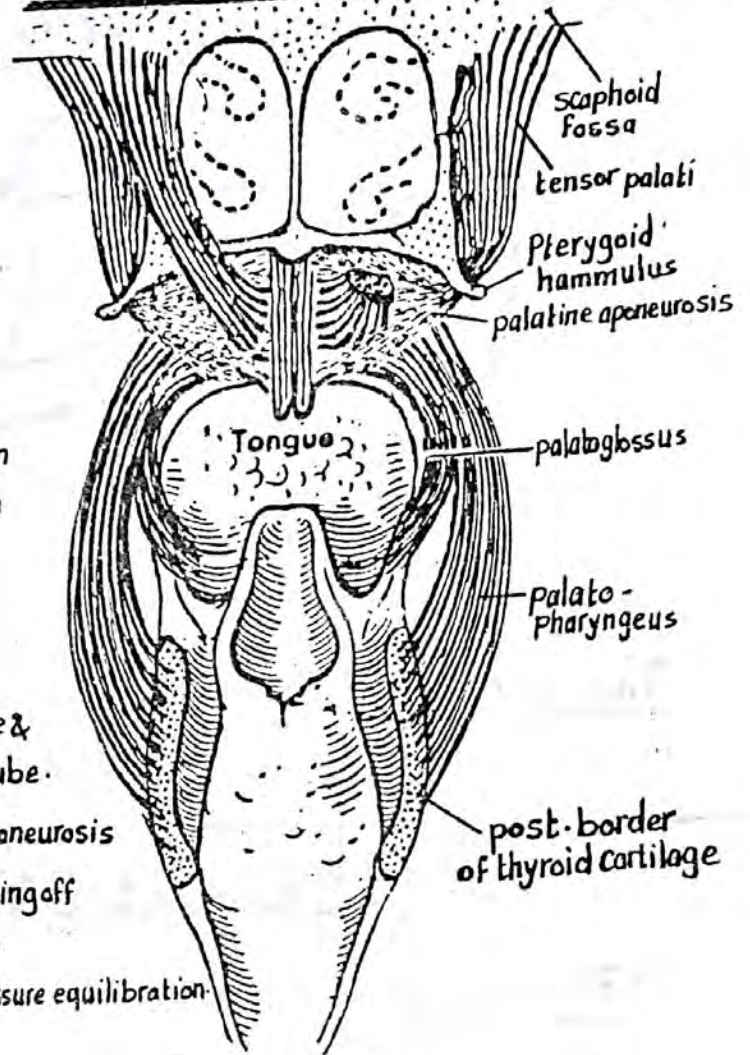
- * **Action**: (1) makes the soft palate tense & tight separating the oropharynx from nasopharynx during swallowing.
- (2) keeps the Eustachian tube patent.

* **Relations**:

- superiorly: base of skull.
- inferiorly: upper border of sup. constrictor m.
- medially: Eustachian tube.
- laterally: the 2 pterygoid muscles but separated from them by mandibular n. & its branches, otic ganglion, chorda tympani, middle & accessory meningeal a.a.

(2) Levator palati m.:

- * **Origin**: From the apex of the petrous temporal bone & from the lower aspect of the Eustachian tube.
- * **Insertion**: into the upper surface of the palatine aponeurosis
- * **Action**: (1) elevates the stiffened soft palate shutting off the nasopharynx from the oropharynx.
- (2) opens out the Eustachian tube for pressure equilibration.



(3) Palatoglossus m.:

- * **Origin**: from the lower surface of the palatine aponeurosis
- * **Insertion**: into the post. $\frac{1}{3}$ of the side of tongue (it forms the palato-glossal fold).
- * **Action**: it pulls the tongue upwards to close the oropharyngeal isthmus in the 1st phase of deglutition.

(4) Palatopharyngeus m.:

- * **Origin**: from the lower surface of the palatine aponeurosis
- * **Insertion**: into the post. border of the lamina of thyroid cartilage (it forms the palatopharyng. fold).
- * **Action**: pulls the larynx up & shortens the pharynx in the 2nd phase of deglutition.

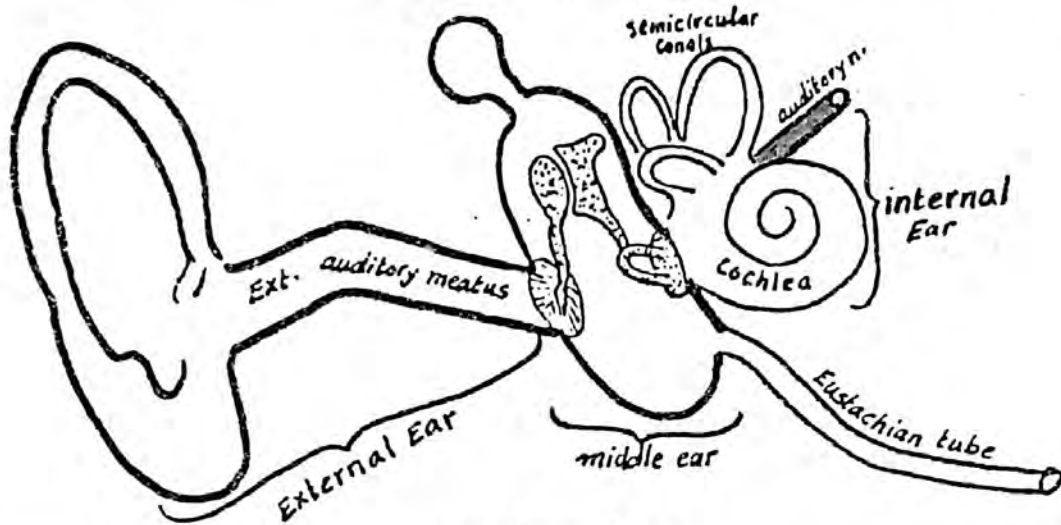
(5) Musculus uvulae:

- * **origin**: From the post. nasal spine of hard palate.
- * **Insertion**: into the mucous memb. of the uvula.
- * **Action**: pulls the uvula to its own side & above.

Nerve Supply of the palate

- (1) **Motor**: all palatine muscles are supplied by the cranial accessory n. (through vagus) except: tensor palati which is supplied by mandibular n.

- (2) **Sensory**: (a) greater palatine & long sphenopalatine nn. supply hard palate (b) lesser palatine n. supplies soft palate.



The ear Consists of:

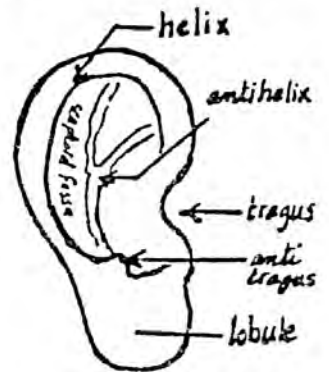
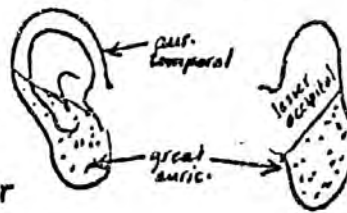
- (1) External ear.
- (2) Middle ear (Tympanic cavity).
- (3) Internal ear (Labyrinth).

A- EXTERNAL EAR

auricle
external auditory meatus (canal)
ear drum

(1) The auricle:

- is formed of yellow elastic cartilage except its lobule (the most dependent part) which is devoid of cartilage.
- Cutaneous nerve supply:
 - (a) auriculotemporal n.: supplies the upper $\frac{1}{2}$ of its outer surface.
 - (b) lesser occipital n.: supplies the upper $\frac{1}{2}$ of the inner surface.
 - (c) great auricular n. supplies the lower $\frac{1}{2}$ of both outer & inner surfaces
 - (d) auricular br. of vagus: supplies an area on the inner surface.



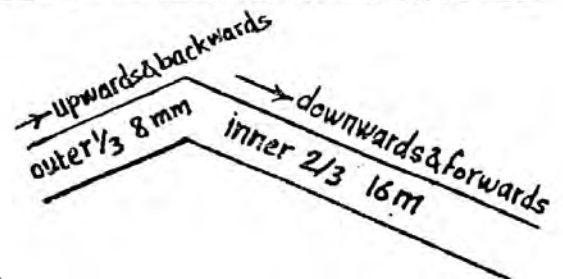
(2) The External auditory meatus:

* length: about one inch (24 mm).

* Parts:

(a) outer $\frac{1}{3}$ $\left\{ \begin{array}{l} \text{Cartilagenous} \\ 16 \text{ mm. long} \\ \text{directed upwards \& backwards} \end{array} \right.$

(b) inner $\frac{2}{3}$ $\left\{ \begin{array}{l} \text{bony} \\ 16 \text{ mm long} \\ \text{directed downwards \& forwards} \end{array} \right.$



(3) The ear drum:

- * Size : 10 mm X 8 mm.
- * Site : it separates the external auditory meatus from the middle ear cavity
- * position : it lies obliquely so that :
its outer surface is directed downwards, forwards & laterally

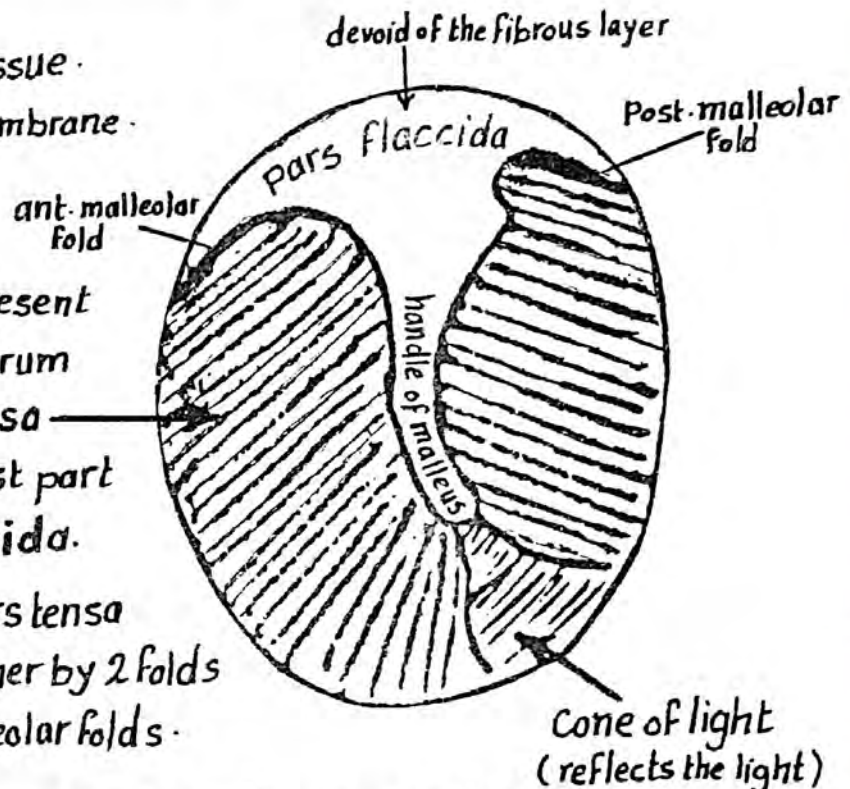


* Structure : semitranslucent membrane formed of :

- (1) outer layer of skin.
- (2) middle layer of fibrous tissue.
- (3) inner layer of mucous membrane.

N.B :

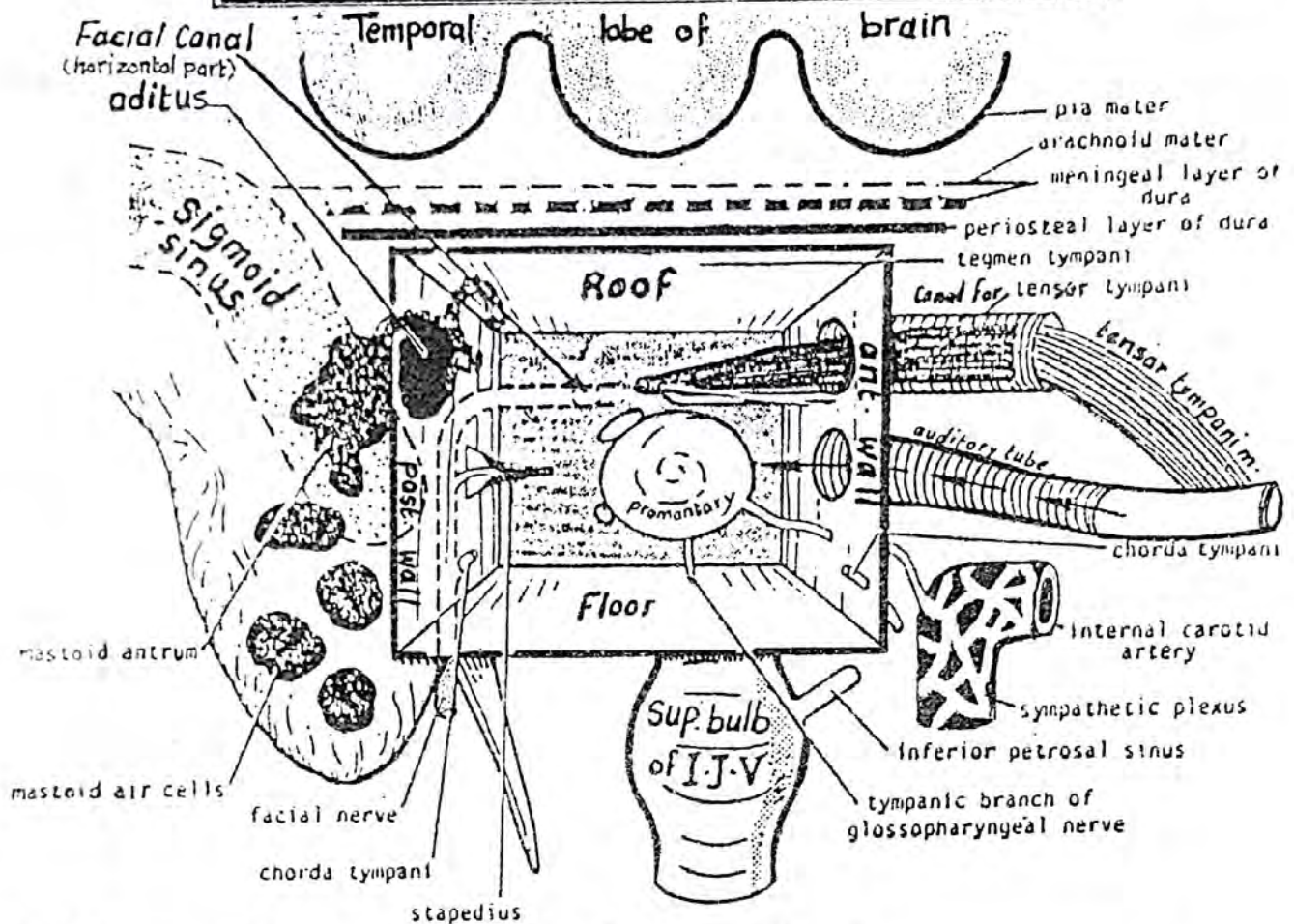
- (1) the middle fibrous layer is present in the major part of the ear drum which is called the **pars tensa** but absent in the upper most part which is called **pars flaccida**.
- (2) the pars flaccida & the pars tensa are separated from each other by 2 folds called the ant. & post. malleolar folds.
- (3) the antero-inferior quadrant of the ear drum is called the cone of light (because it reflects the light coming from the examiner's mirror).



* Nerve Supply of ext. auditory meatus & ear drum:

- (1) auriculotemporal n. : supplies the ant. $\frac{1}{2}$.
- (2) auricular br. of vagus : supplies the post. $\frac{1}{2}$.
- (3) tympanic plexus : supplies the inner surface of ear drum.

N.B : the tympanic plexus is formed mainly by the tympanic br. of glossopharyngeal nerve.



* **Site**: inside the petrous part of the temporal bone

* **Shape**: small biconcave box (like red blood corpuscle set on its edge). Its vertical axis is roughly parallel to the plane of the ear drum.

* **Surfaces**: it has roof, Floor & 4 walls: ant., post, medial & lateral.

I- Roof (tegmental wall)

* it is formed by a thin plate of bone called tegmen tympani.

* it separates the middle ear cavity from the temporal lobe in the middle cranial fossa.

II- the Floor

* Formed by a thin plate of bone called the jugular wall.

* it separates the middle ear cavity from the jugular fossa containing the sup. bulb of the I.J.V.

* it is pierced by the tympanic br. of the glossopharyngeal n.

III- Lateral Wall

* Formed mainly by the ear drum.

IV - Anterior Wall

173

Contains the following structures (arranged from above downwards):

- (1) the opening of the canal for tensor tympani m. (in the upper part).
- (2) " " " " Eustachian tube (in the middle part)
- (3) a plate of bone separating the middle ear cavity from the I.C.A in the carotid canal.

V - Posterior Wall

* Contains the following structures (from above downwards):

- (1) the aditus (opening) leading to the mastoid antrum.
- (2) the pyramid: a hollow conical process containing the stapedius m.
- (3) the vertical part of the facial canal (for facial n.) med. to the aditus.

VI - Medial (Labyrinthine) Wall

* Separates the middle ear cavity from internal ear & shows the following features:

- (1) a well marked rounded bulge called the promontory which is produced by the first turn of the cochlea of the inner ear.
- (2) oval window: lies above & behind the promontory. It is closed by the foot of the stapes & leads to the vestibule of the internal ear.
- (3) rounded window: lies below & behind the promontory & is closed by 2nd tympanic membrane.
- (4) the horizontal part of facial canal: arching above the promontory & oval window.

THE PHARYNGO-TYMPANIC TUBE (EUSTACHEAN TUBE)

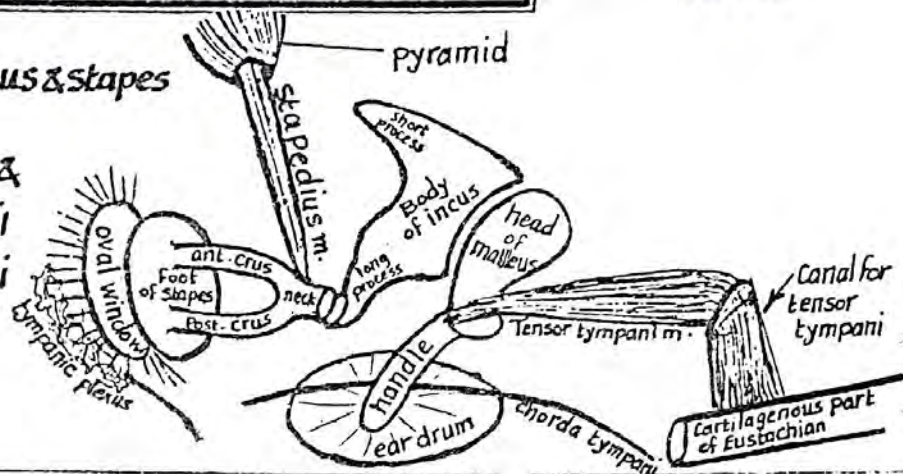
- * it is an osseo-cartilagenous canal connecting the tympanic cavity with nasopharynx.
- * it is 36 mm. long, its bony part is 12 mm. while the cartilagenous part is 24 mm.
- * it extends downward, forwards & medially from the middle ear cavity forming 45° with the sagittal plane.
- * Relations: (1) superiorly: base of skull (2) inferiorly: sup. constrictor m. of pharynx.
- (3) medially: it gives origin to the levator palati m.
- (4) laterally: it is covered partially by tensor palati (giving origin to it) & is related to the otic ganglion & mandibular n.
- * Nerve supply: from the tympanic plexus & the pharyngeal br. of sphenopalatine ganglion.

(1) 3 ossicles : Malleus, incus & stapes

(2) 2 muscles : stapedius & tensor tympani

(3) 2 nerves : chorda tympani & tympanic plexus

(4) Air



A- the 3 ossicles

(1) Malleus :

- * its handle is attached to the inner surface of the ear drum (pulling it inwards).
- * its handle also receives the insertion of the tensor tympani m.
- * its head articulates with the incus.

(2) Incus : (the intermediate ossicle) :

- * looks like a tooth with a body & 2 processes : long & short.
- * its body articulates with the malleus.
- * its long process articulates with the head of stapes.

(3) Stapes : (the medial ossicle) :

- * its small head articulates with the long process of the incus.
- * its foot closes the oval window of the internal ear.

B- the 2 muscles

(1) Tensor tympani :

- origin : from the cartilaginous part of the Eustachian tube.
- insertion : it runs in a small bony canal which opens into the ant. wall of the middle ear cavity then becomes inserted into the handle of malleus.
- N. supply : br. from the n. to med pterygoid m. (from main trunk of mandibular n.).

(2) Stapedius m. :

- * origin : from the inner walls of the pyramid of the post-wall of tympanic cavity.
- * insertion : into the post. aspect of neck of stapes.
- * n. supply : n. to stapedius from the facial n.

* Action of the Intra tympanic muscles:

175

- (a) Tensor tympani : pulls the tympanic membrane inwards protecting it from excessive movements.
- (b) Stapedius m. : damps down excessive movements of stapes.
thus the 2 muscles produce an action of damping down the intensity of high pitched sounds.

C- The Nerves inside middle ear

(1) Chorda tympani:

* Origin : arises from the facial n. as it descends in the vertical part of the facial canal.

* Course :

- (1) it enters the middle ear cavity through the post. canaliculus for chorda tympani.
- (2) it runs forwards between the handle of malleus & the mucous memb. of eardrum.
- (3) it leaves the middle ear cavity through the ant. canaliculus for chorda tympani (in the squamotympanic fissure) to reach the infratemporal fossa.
- (4) it ends by joining the lingual n. deep to the lat. pterygoid m. (see page 140).

(2) Tympanic plexus:

* Site : on the promontory of cochlea on the med. wall of the middle ear cavity.

* Formation : it is formed by : (1) the tympanic br. of glossopharyngeal n.

- (2) Carotico tympanic symp. fibres from the plexus around the I.C.A.

* branches : it supplies the mucous memb. of the tympanic cavity, Eustachian tube & mastoid air cells. It also gives the lesser superficial petrosal (preganglionic parasymp. fibres to the parotid gland).

N.B : the facial n. runs in the facial canal which has a horizontal part (in the med. wall of tympanic cavity) & a vertical part (in the post. wall of tymp. cavity).

* Arterial Supply of the middle ear :

- (1) ant. tympanic a. (br. of maxillary a.) (2) post. tympanic a. (br. of post. auric. a.).
- (2) sup. " " (" " middle meningeal a.) (4) inf. " (from asc. pharyngeal a.).

* Lymphatic drainage : the lymphatics of the middle ear & mastoid antrum drain into parotid L.Ns & upper deep cervical L.Ns.

INTERNAL EAR

see page 194

* Definition : It is the styloid process of temporal bone & the structures attached to it which are :

(A) 2 Ligaments : (1) Stylomandibular lig. (2) Stylohyoid lig.

(B) 3 Muscles : (1) Styloglossus m. (2) Stylohyoid m. (3) Stylopharyngeus m.

* Relations of the styloid process:

(1) superficial to it : parotid gland & facial nerve.

(2) deep to it : internal carotid a.

N.B : Styloid process separates the I.C.A. (deep to it) from E.C.A. (superficial to it inside the parotid gland).

* Anatomy of the Styloid apparatus

(A) Ligaments:

(1) Stylomandibular lig.:

* attached above to the lat. aspect of styloid process near its tip

* attached below to the angle & post. border of ramus of mandible

* it is a thickened part of the deep fascia of neck deep to the parotid gland.

* it separates the lower pole of parotid from the post. end of submandibular gland

* it is an accessory lig. to the T.M.J.

(2) Stylohyoid lig.:

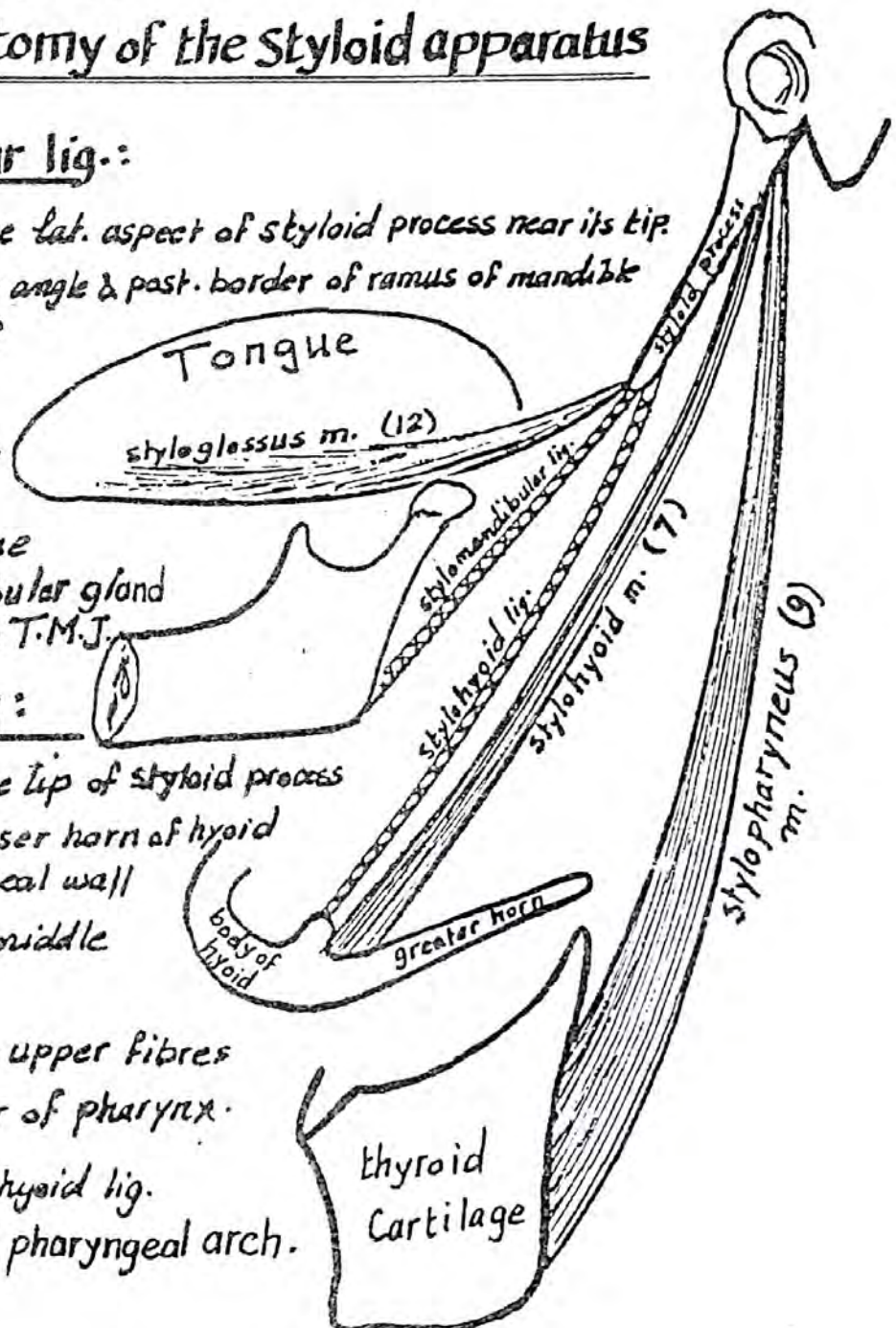
* attached above to the tip of styloid process

* attached below to lesser horn of hyoid

* it enters the pharyngeal wall between the sup. & middle constrictors.

* it gives origin to the upper fibres of middle constrictor of pharynx.

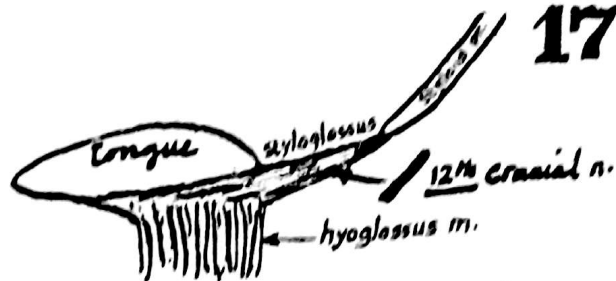
* Embryologically, stylohyoid lig. arises from the 2nd pharyngeal arch.



(B) Muscles:

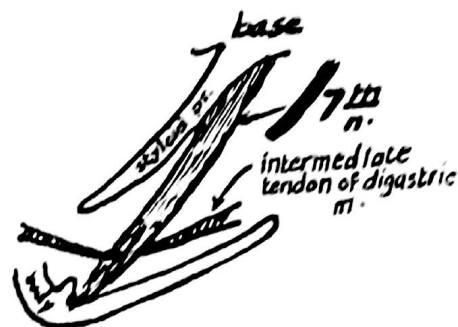
177

(1) Styloglossus muscle:



- * Origin: tip of styloid process.
- * Insertion: post. part of side of tongue decussating with hyoglossus m.
- * N. supply: 12th cranial n.
- * Embryological origin: occipital myotome.
- * Action: retracts the tongue.

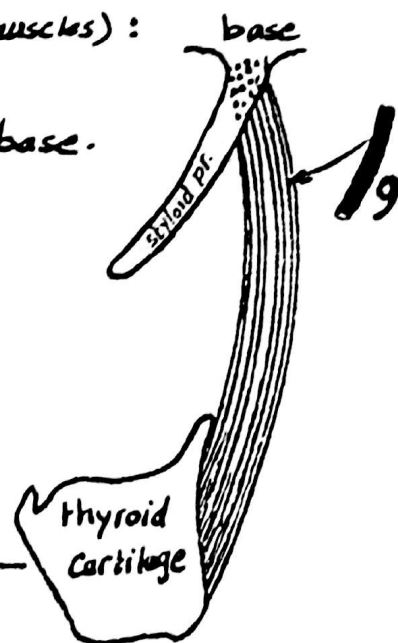
(2) Stylohyoid m.:



- * Origin: post. aspect of styloid process near its base.
- * Insertion: at the junction of body of hyoid with the greater horn.
- * N.B: its tendon of insertion is split by the intermediate tendon of digastric
- * N. supply: 7th cranial n.
- * Embryological origin: 2nd pharyngeal arch.
- * Action: elevates hyoid bone.

(3) Stylopharyngeus m. (the largest of the 3 muscles):

- * Origin: med. aspect of styloid process near its base.
- * Insertion: post. border of thyroid cartilage.
- * N. supply: 9th cranial n.
- * Embryological origin: 3rd pharyngeal arch.
- * Action: elevates the larynx & pharynx during swallowing & phonation.

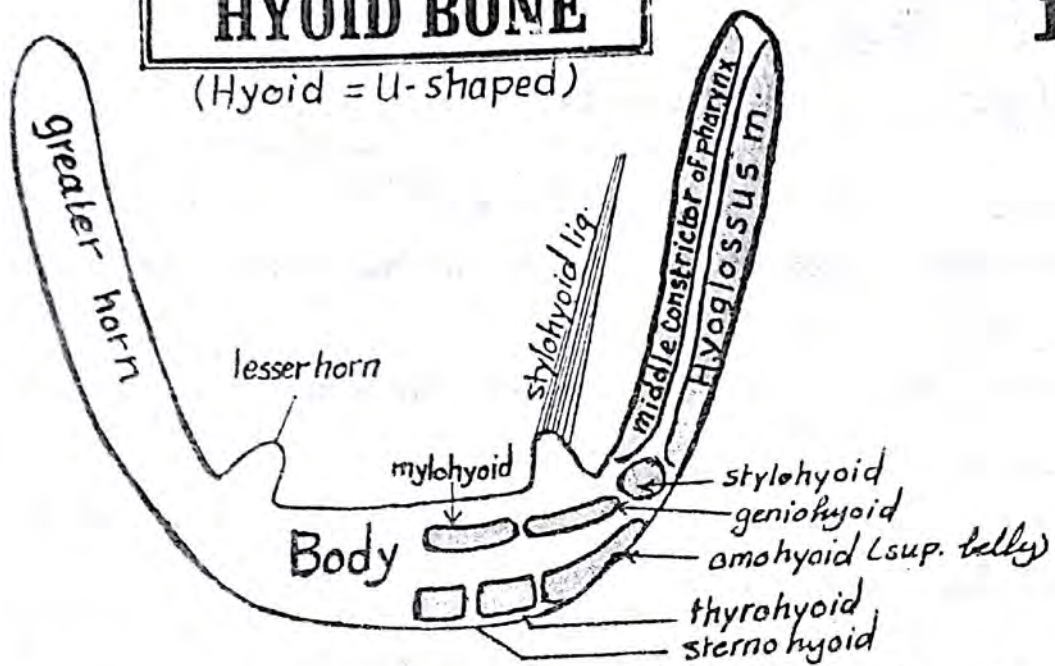


- * N.B: the 3 muscles of the styloid process arise from one bone & have different insertions (Comparable to the guy-ropes of pelvis: S-G-S which arise from 3 different bones but have common insertion).

HYOID BONE

(Hyoid = U-shaped)

178



* Site : below the tongue & in front of the epiglottis opposite the disc between C2 & C3.

* Structure : body, 2 lesser horns & 2 greater horns.

- the body is quadrilateral & looks forwards & upwards.
- the lesser horns : project upwards from the junction between the body and greater horns.
- the greater : project backwards from the lateral ends of the body.

* Muscles arising from hyoid bone : 2 :

- (1) Hyoglossus
 - (2) middle constrictor m. of pharynx
- } arise from the greater horn.

* Muscles inserted into hyoid bone : (6) :

- | | | |
|------------|---|--|
| suprahyoid | (1) <u>stylohyoid m.</u> & the fibrous loop connecting intermediate tendon of digastric to the hyoid. | (1) <u>stylohyoid lig.</u> : to the apex of lesser horn.
(2) <u>thyrohyoid memb.</u> : to the med. border of greater horn.
(3) <u>hyo-epiglottic lig.</u> : to the upper border of the body. |
| | (2) <u>mylohyoid</u> | |
| | (3) <u>geniohyoid</u> | |
| infrahyoid | (4) <u>omohyoid</u> | |
| | (5) <u>sternohyoid</u> | |
| | (6) <u>thyrohyoid</u> | |

* Ligaments attached to the hyoid bone

* Functions of Hyoid bone : acts as centre for muscles acting on tongue, pharynx, larynx.

A- Suprahyoid structures (above hyoid bone):

(1) Bone : the symphysis menti.

(2) Muscles :

- (a) the decussating fibres of the 2 platysmae.
- (b) origin of ant. bellies of the 2 digastric muscles.
- (c) fibrous raphe of the 2 mylohyoid muscles

(3) Vessels & Nerves :

- (a) submental L. vessels & L. nodes.
- (b) the beginning of ant. jugular veins.

B- Body of hyoid bone :

with supra- & infrahyoid arteries above & below it.

C- Infrahyoid structures :

1- Cartilages:

- (a) laryngeal prominence of thyroid cartilage.
- (b) arch of cricoid cartilage.
- (c) upper 8 tracheal rings.
- (d) supra sternal notch of manubrium sterni.

2- Ligaments & membranes:

- (a) thyrohyoid membrane (between hyoid & thyroid cart.).
- (b) cricothyroid membrane (" cricoid & thyroid cartilages).
- (c) crico-tracheal lig. (between cricoid cart. & 1st tracheal ring).
- (d) interclavicular lig. (between the med. ends of the 2 clavicles).

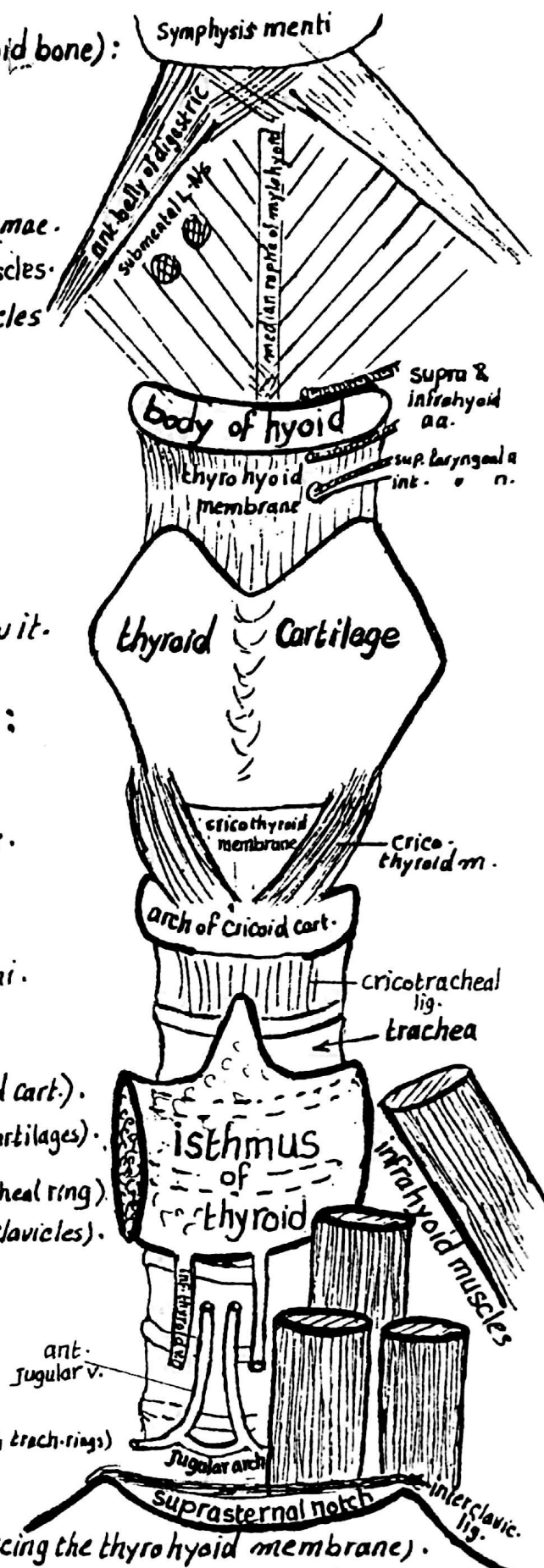
3- Muscles :

- (a) cricothyroid mm.
- (b) the 4 infrahyoid muscles.

4- Gland: isthmus of thyroid gland (opposite 2,3,4 trach. rings)

5- Vessels & Nerves:

- (a) sup. laryngeal a. & internal laryngeal n. (piercing the thyrohyoid membrane).
- (b) the 2 ant. jugular veins & the jugular arch connecting them 1" above the sternum).
- (c) the inf. thyroid veins emerging from the isthmus
- (d) the thyroid ima artery ascending to " " } in front of the tracheal rings.



- * The lymphatic tissue of the H & Neck forms $\frac{1}{3}$ of the lymphatic tissue of the whole body.
- * the lymphatic tissue of the H & N is divided into $\begin{cases} \text{the adenoid tissue} \\ \text{the lymph nodes} \end{cases}$.

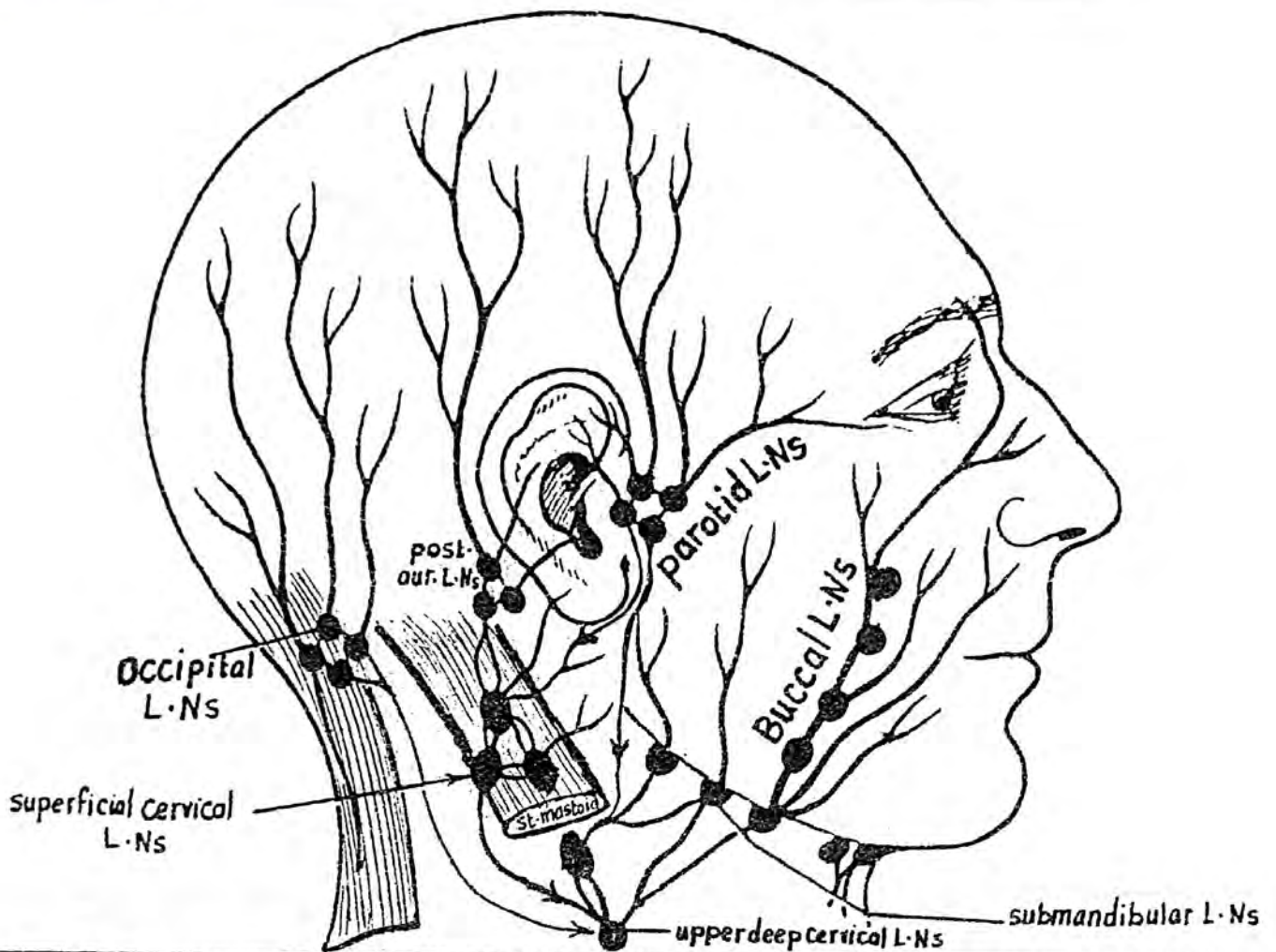
1-ADENOID TISSUE

- * it is the aggregation of lymphoid tissue which guards the entrance of the alimentary & respiratory tracts.
 - * it forms a ring called the lymphatic ring of Waldeyer which includes :
 - (1) Superiorly: the nasopharyngeal tonsil at the roof & the post. wall of the nasopharynx.
 - (2) inferiorly: the lingual tonsil on the dorsum of the post. $\frac{1}{3}$ of the tongue.
 - (3) laterally: the palatine tonsils: one on either side of the nasopharyngeal isthmus between the palatoglossal & the palatopharyngeal folds.
 - * Drainage: efferent lymphatics from the Waldeyer's ring drain into the upper deep cervical lymph nodes.
-

2-LYMPH NODES OF THE H & N

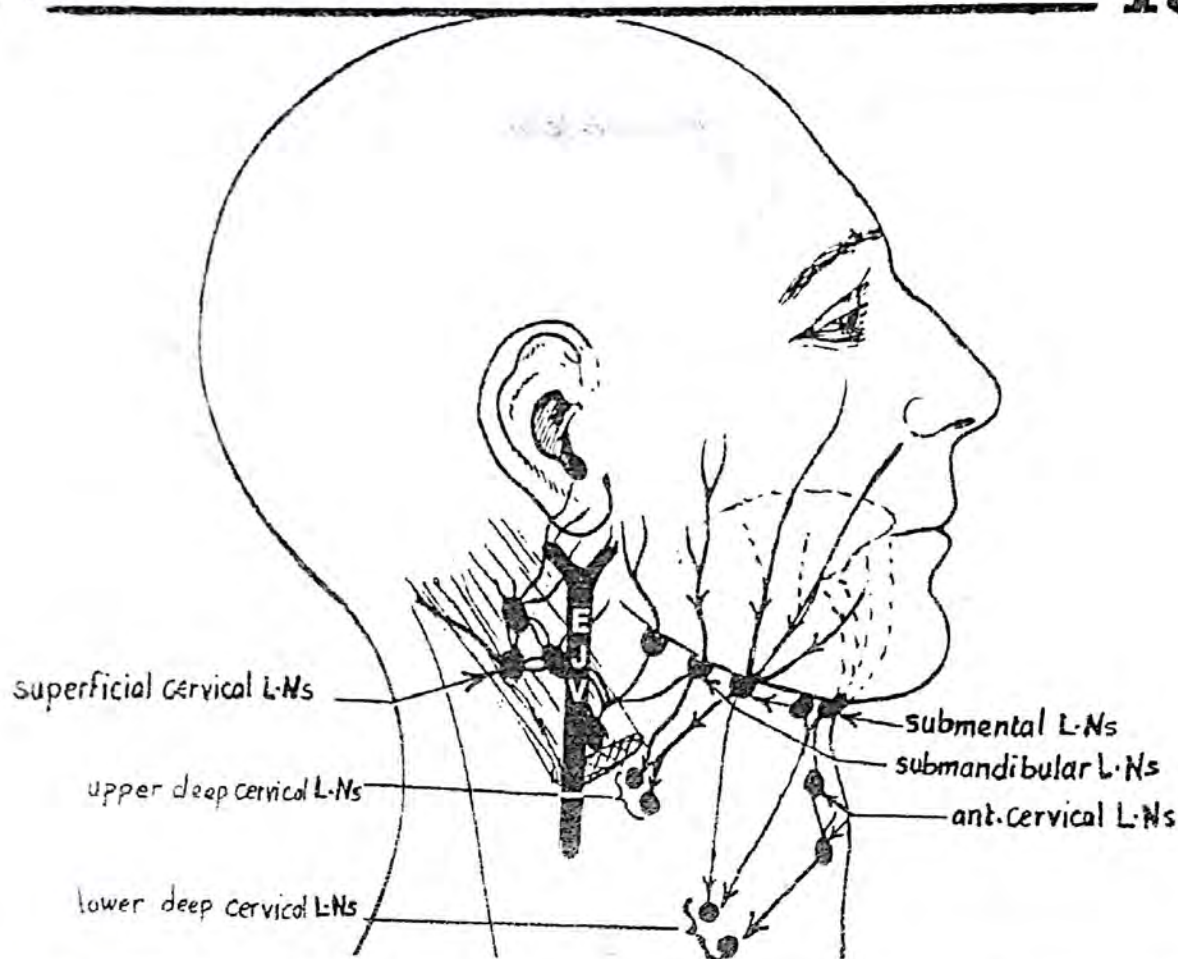
- * The Lymph nodes of the H & N. are arranged in :
 - (a) superficial circular group.
 - (b) deep circular group
 - (c) vertical chain inbetween the 2 circular groups.
- * these groups drain the superficial & the deep structures of the H & N.
- * the superficial & the deep circular groups drain into the vertical group which is called the deep cervical L. Ns lying alongside the I.J.V deep to the sternomastoid m.

(A) THE SUPERFICIAL CIRCULAR L.Ns OF THE HEAD



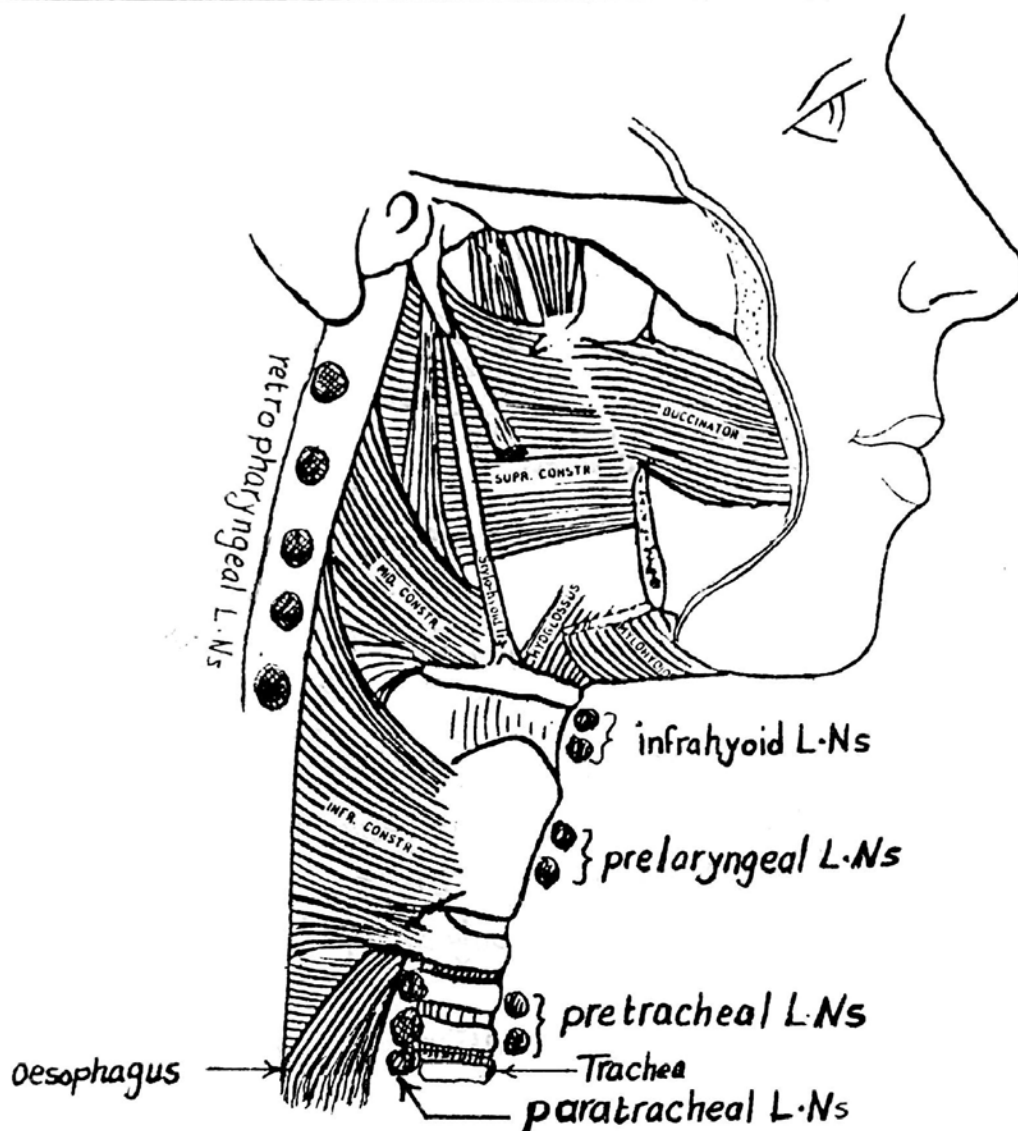
Lymph Nodes	site	area drained	efferent lymphatics pass to
1-Occipital L. Nodes	along the occipital a. at the apex of the post. Δ of neck	(1) the post. part of Scalp (2) the back of the neck	upper deep cervical L. Ns.
2-Post-auricular L. Nodes	along the post-auricular vessels behind the auricle	(1) post. part of the scalp. (2) auricle & ext. auditory meatus	» » » »
3-Parotid L.Ns: superficial & deep	on the surface of parotid & embedded inside it.	(1) temporal region (2) auricle & ext. auditory meatus (3) upper ½ of face & eye lids (4) gums	» » » » & superficial cervical L. Ns
4- Buccal L. Ns	along the facial vessels on the buccinator m. & the mandible	(1) the cheeks (2) the lips	submandibular L. Ns.

(B) THE SUPERFICIAL CIRCULAR L.Ns OF THE NECK 182



Lymph nodes	Site	Areas drained	efferent lymphatics
(1) Submental L.Ns.	in the submental Δ lying on mylohyoid m.	(1) tip of tongue (bilateral) (2) floor of mouth (")	(1) to submandib. L.Ns (2) to lower deep cervical L.Ns
(2) Submandibular L.Ns.	in the submandibular region between the submandibular gland & the mandible	(1) most of the face (cheeks, lips & nose) (2) Floor of the mouth (3) side of the tongue.	(1) to upper deep cervical L.Ns (2) lower deep cervical L.Ns.
(3) Ant. Cervical L.Ns.	along the ant. jug. v particularly above the sternum (suprasternal L.Ns)	ant. region of the neck below the hyoid bone	(1) pre tracheal L.Ns (2) upper deep cervical L.Ns
(4) Superficial Cervical L.Ns.	along the Ext. Jug. v on sternomastoid m.	(1) lobule of ear & ext. auditory meatus (2) parotid gland	to upper & Lower deep cervical L.Ns.

(C) THE DEEP CIRCULAR L.Ns OF THE H.&N 183



Lymph Nodes	Site	areas drained	Efferent Lymphatics
(1) Retropharyngeal L.Ns	behind the pharynx . in front of prevertebral fascia	(1) nasopharynx (2) paranasal sinuses (3) Eustachian tube	to upper deep cervical L.Ns
(2) Paratracheal L.Ns	alongside the trachea & oesophagus	(1) pharynx & larynx (2) trachea & oesophagus (3) thyroid gland.	upper & lower deep cervical L.Ns
(3) Infrahyoid L.Ns (4) prelaryngeal L.Ns (5) pretracheal L.Ns	in front of thyrohyoid memb. in front of the larynx along inf. thyroid veins	} drain the larynx	to upper & lower deep cervical L.Ns

* these are the main lymph nodes in the neck.

* they lie alongside the Carotid sheath closely related to the I.J.V & overlapped by sternomastoid m.

* The L.Ns of this vertical chain are divided into 2 groups:

(A) - Upper deep cervical L.Ns :

- arranged along the upper part of the I.J.V deep to the sternomastoid.
- the most important member of this group is called the **jugulo-digastric L.N** lying in the angle between the I.J.V & the post. belly of digastric m. It is the main L.N draining the tonsil (the most commonly enlarged L.N. in the body).
- the upper deep cervical L.Ns send their efferent lymphatics to the lower deep cervical L.Ns.

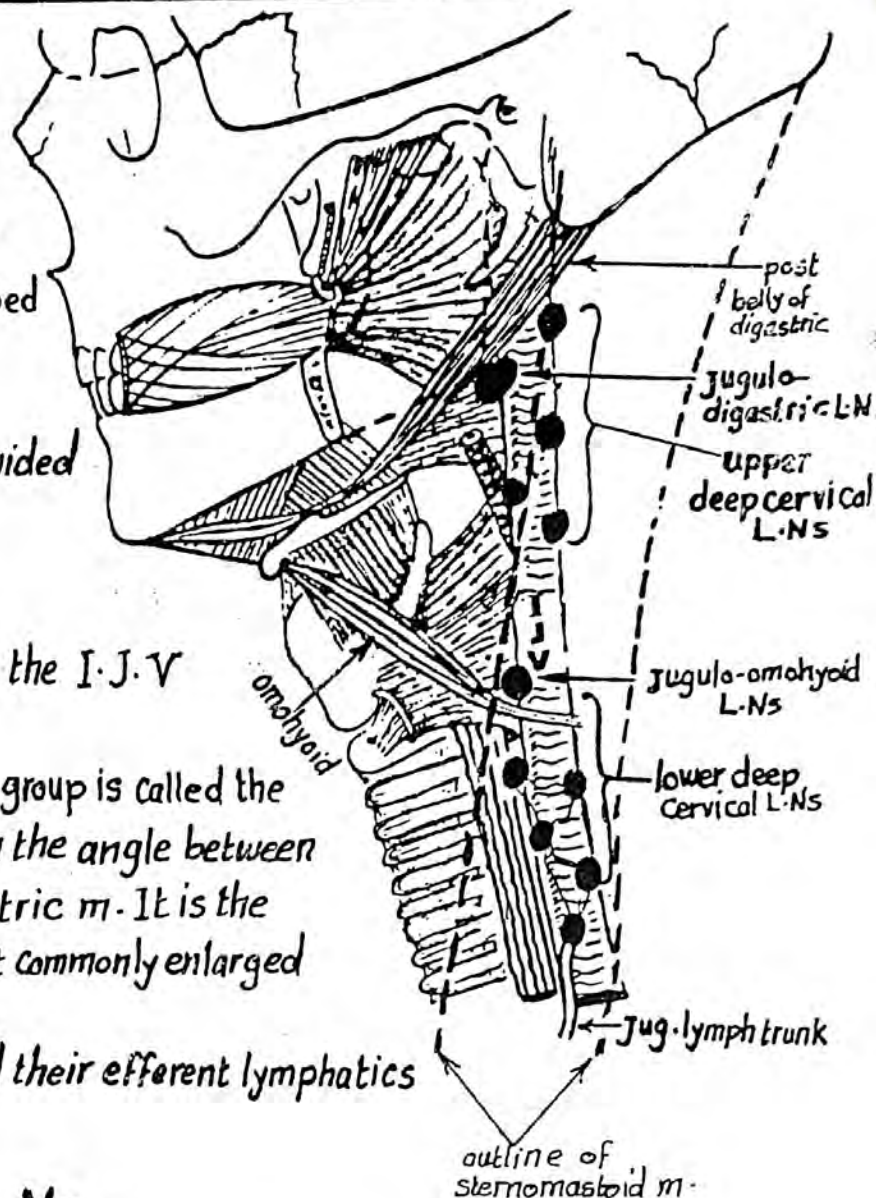
(B) Lower deep cervical L.Ns .

- arranged along the lower part of the I.J.V deep to the sternomastoid.
- the most important member of this group is the **jugulo-omohyoid L.N** lying in the angle between the I.J.V & the intermediate tendon of omohyoid m.

* The upper & lower deep cervical L.Ns drain all the superficial & deep circular groups of L.Ns in the head & neck .

* Efferents from the lower deep cervical L.Ns collect to form the **jugular Lymph trunk** which ends in :

- the thoracic duct on the Lt. side .
- the Rt. lymphatic duct on the Rt. side .



I- TEMPORO-MANDIBULAR JOINT (T.M.J)

(1) Type & Variety : synovial of condylar variety.

(2) Articular surfaces :

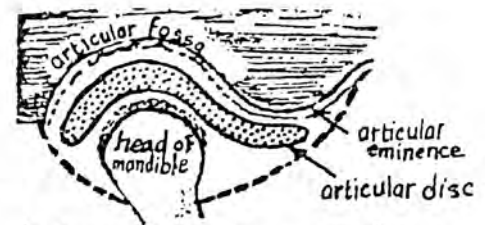
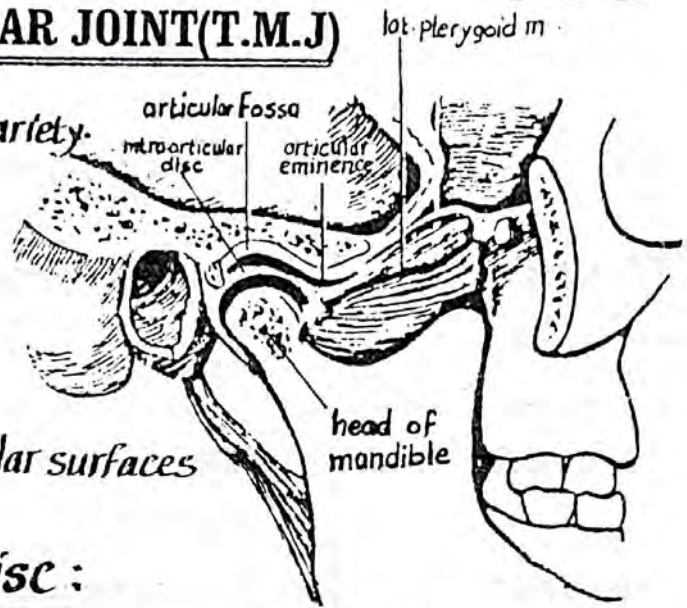
(a) above : the articular fossa & articular tubercle of the temporal bone.

(b) below : the head of the mandible.

(3) Capsule : attached around the articular surfaces above & below.

(4) the intracapsular articular disc :

the joint cavity is divided into an upper & a lower compartments by an intra articular disc of fibrocartilage. The upper surface of the disc is concavo-convex to fit into the articular fossa & articular tubercle while the lower surface is concave to fit into the head of mandible. The circumference is adherent to the capsule & gives attachment to the tendon of insertion of lat. pterygoid m.



(5) Accessory ligaments :

(a) Lateral (temporomandibular) ligament :

- it is triangular in shape. Its base is attached to the root of zygoma while its apex is attached to the lat. aspect of neck of mandible.

- It is the main lig. of the T.M.J.

(b) Spheno-mandibular ligament :

- it lies on the med. side of the joint but separated from it by a wide space.

- it is attached above to the spine of sphenoid & below to the lingula of the mandible.

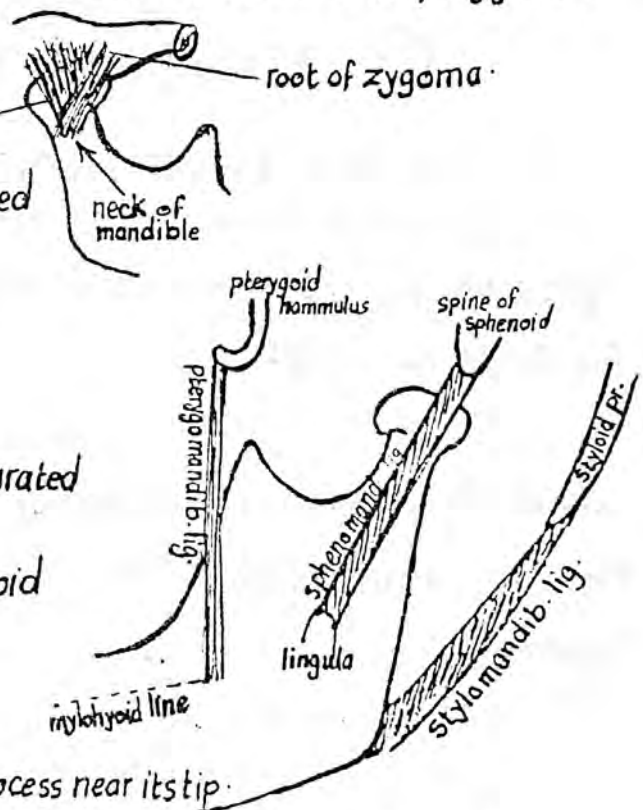
(c) Stylo-mandibular ligament :

* attached above to the lat. aspect of styloid process near its tip.

* attached below to the post. border of the ramus of mandible above the angle.

(d) Pterygomandibular lig. :

extends from the pterygoid hamulus to the post-end of mylohyoid line of mandible.



(d) pterygo-mandibular lig.

- extends from the pterygoid hamulus to the post. end of mylohyoid line of mandible

N.B : the main lig. of the T.M.J is the lat. temporomandibular lig.

(6) Nerve supply of the joint : auriculotemporal n. & masseteric nerve(7) Movements allowed & muscles producing it.

Movement of Mandible	Muscles responsible for the movement
(1) Depression	lat. pterygoid, mylohyoid, ant. belly of digastric, geniohyoid & platysma.
(2) Elevation	Masseter, temporalis & med. pterygoid.
(3) Protrusion	lat. & med pterygoid + superficial fibres of masseter m.
(4) Retraction	post. fibres of temporalis.
(5) side to side movement	Med. & Lat. pterygoid muscles.

II- ATLANTO-OCCIPITAL JOINTS

it is the articulation between the occipital condyles of the skull & the sup. kidney shaped articular surfaces of the lat. mass of the atlas vertebra.

* Type & variety of the joint : it is a synovial joint of condylar variety.

* Articular surfaces:

(a) above : the occipital condyles of the skull.

(b) below : the sup. articular facets of the atlas.

* Capsule : attached around the articular surfaces.

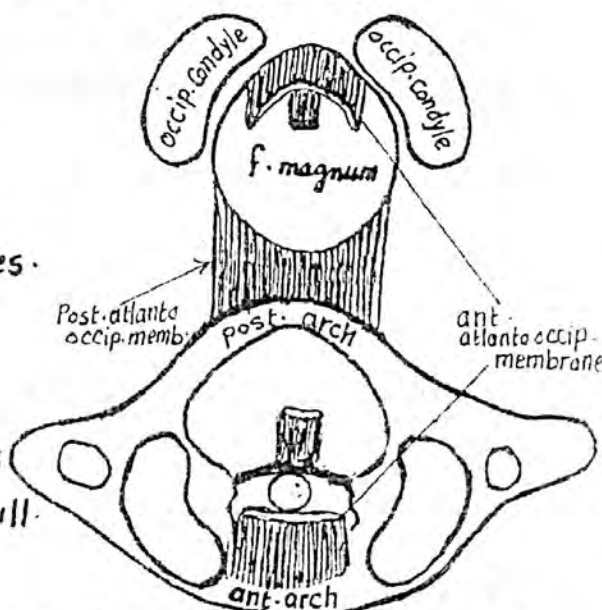
* Ligaments:

(1) ant. atlanto-occipital membrane :

Connects the upper border of the ant. arch of atlas to the ant. margin of the foramen magnum of the skull.

(2) post. atlanto-occipital membrane :

Connects the upper border of the post. arch of atlas to the post. margin of f. magnum.



* Movements occurring in the atlanto-occipital joints :

(1) Flexion & extension (nodding)

(2) Slight lat. flexion.

* Muscles producing the movements :

(a) flexion : produced by : longus capitis & rectus capitis ant.

(b) extension : " : rectus capitis post. major & minor, splenius capitis & semispinalis capitis.

III- ATLANTO-AXIAL JOINTS

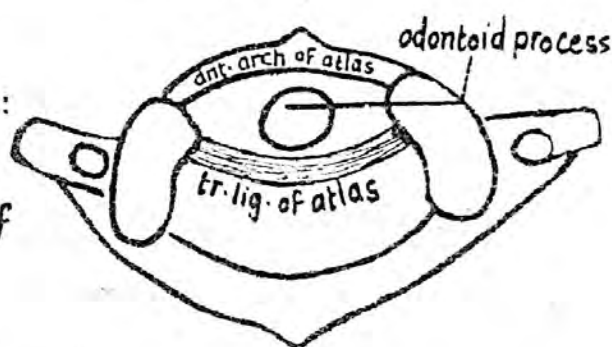
(1) 2 lat. atlanto-axial joints :

- each one is a plane synovial joint between the inf. articular facet of the lat. mass of the atlas & a corresponding facet on the upper surface of the body of the axis.
- each joint has a thin capsule attached around the articular surfaces.

(2) The Median atlanto-axial joint :

* it is a synovial joint of pivot variety between :

- (a) the odontoid process of the axis vertebra &
- (b) an osseofibrous ring formed by the ant. arch of atlas & the transverse lig. of atlas.



* Movements of the atlanto-axial joints : rotation.

LIGAMENTS CONNECTING THE AXIS WITH THE OCCIPITAL BONE

- (1) Membrana tectoria : it is the upward continuation of the post. longitudinal lig. of the vertebral column. It extends from the back of body of axis to the upper surface of the basilar part of occipital bone in front of f. magnum.
- (2) Alar ligaments : 2 strong fibrous cords extending from the sides of the upper part of the odontoid process to the medial sides of the occipital condyles.
- (3) Apical ligament : this is a short lig. extending from the tip of the odontoid process to the ant. margin of the f. magnum.

CERVICAL VERTEBRAE

188

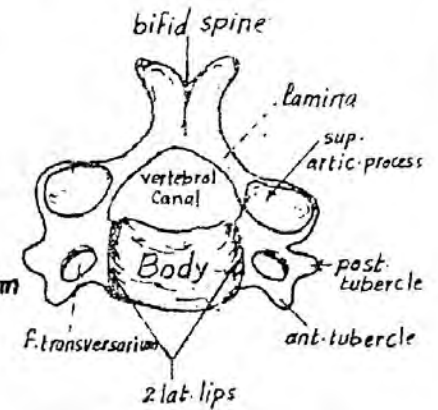
* They are 7 in number. All are characterized by the presence of foramen transversarium in the transverse processes.

* They are classified into: (a) typical vertebrae; these are 3, 4, 5, 6
(b) nontypical: these are 1, 2, 7

(A) Typical Cervical vertebrae (3, 4, 5, 6):

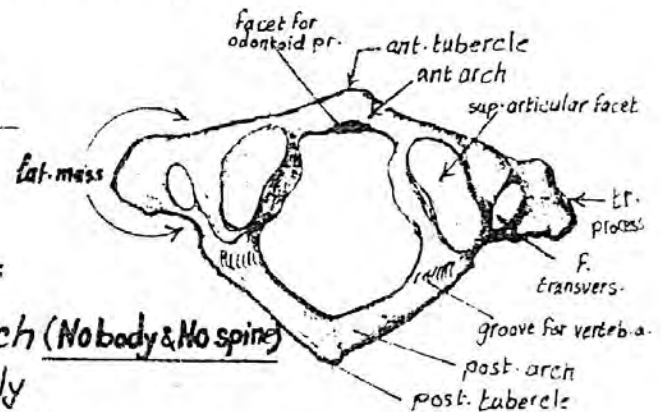
they are characterized by the following features:

- (1) the Body: is small in size & has 2 lat. lips above, ant. & post. lips below.
- (2) the transverse process: is perforated by foramen transversarium & has ant. & post. tubercles.
- (3) the Spine: is short & bifid
- (4) the sup. articular processes are directed posterosuperiorly while the inf. articular processes are directed anteroinferiorly.
- (5) the vertebral foramen is large & triangular.



(B) The Atlas (1st cervical) vertebra:

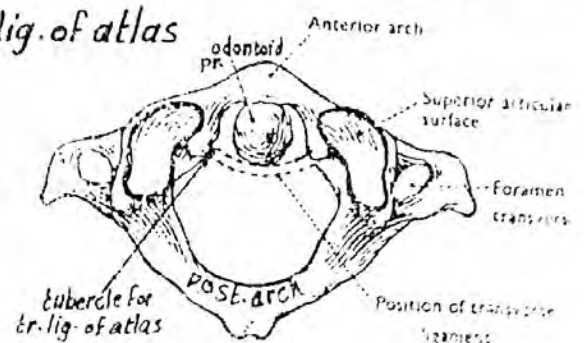
- * it is ring-shaped & formed of 2 lat. masses connected by short ant. arch & long post. arch (No body & No spine)
- * the ant. arch has
 - ant. tubercle: anteriorly
 - facet for articulation with odontoid process: posteriorly.
- * the post. arch has
 - post. tubercle: posteriorly
 - groove for vertebral a. & dorsal ramus of C₁: superiorly



* each lat. mass has

- (1) superior kidney-shaped facet for articulation with occipital condyle of skull.
- (2) inferior circular facet for articulation with the sup. articular facets of axis.
- (3) med. tubercle for attachment of the transverse lig. of atlas
- (4) tr. process containing f. transversarium.

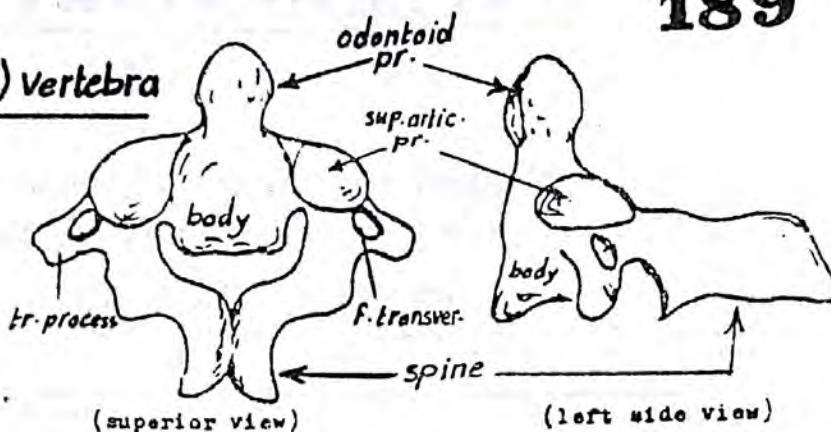
N.B: the atlas has no body & no spine. Its body is separated from it & fused with the axis vertebra to form the odontoid process.



(C) The Axis (2nd cervical) vertebra

it has the following features :

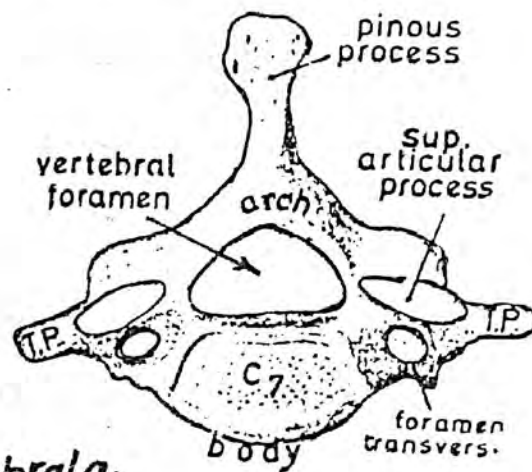
- (1) its body projects upwards forming the odontoid process.
- (2) its spine is thick & very strong.



(D) The Vertebra prominens (C7)

it has the following features :

- (1) its spine is long & blunt (not bifid) & it is the 1st spine felt subcutaneously at the back of neck.
- (2) its foramen transversarius is small > may be absent on one side & does not transmit vertebral a. but transmits accessory vertebral vein.



Anatomical events at the level of C6 (level of cricoid cartilage):

- (1) Carotid tubercle : it is the ant. tubercle of the tr. process of C6 vertebra. It is called so because the C-C-A can be compressed against it.
- (2) Intermediate tendon of omohyoid m. crosses the carotid sheath at C6.
- (3) the Inf. thyroid a. curves medially at the level of C6.
- (4) the middle thyroid v. emerges from the thyroid gland at C6.
- (5) the vertebral a. enters the f. transversarium of C6 vertebra.
- (6) the middle ganglion of the symp. chain lies at the level of C6.
- (7) termination of the larynx & the beginning of the trachea at lower border of C₆.
- (8) " " " pharynx & " " " " oesophagus " " " " " " " " " " " "

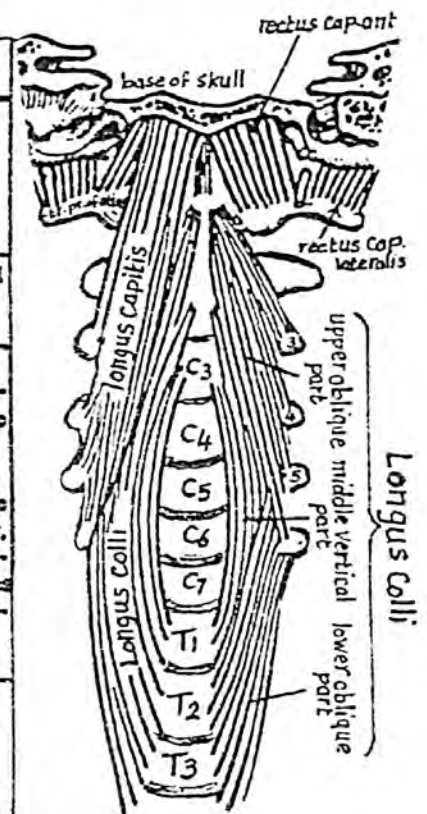
I-- PREVERTEBRAL REGION

* It is the region in front of the vertebral region. It contains :

- (1) prevertebral muscles (see below) (2) prevertebral fascia (page 101)
- (3) 1st & 2nd parts of vertebral a. (p.123) (4) Vertebral Vein (see below).

PREVERTEBRAL MUSCLES

Muscle	Origin	Insertion	Actions
(1) <u>Rectus capitis anterior.</u> Very short and flat; lies deep to longus capitis	Anterior surface of lateral mass of atlas.	Basilar part of occipital bone in front of occipital condyle.	Flexes head.
<u>Rectus capitis lateralis.</u> Short and flat;	Upper surface of transverse process of atlas.	Inferior surface of jugular process of occipital bone.	Flexes head laterally.
(2) <u>Longus colli (cervicis).</u> Extends from atlas to third thoracic vertebra; has upper and lower oblique parts and a middle vertical part.	(a) <u>Upper oblique part:</u> from anterior tubercles of transverse processes of 3, 4, 5 cervical vertebrae. (b) <u>Lower oblique part:</u> from bodies of upper 2-3 thoracic vertebrae. (c) <u>Middle vertical part:</u> from bodies of upper 3 thoracic and lower 3 cervical vertebrae.	(a) <u>Upper oblique part:</u> into the anterior tubercle of atlas. (b) <u>Lower oblique part:</u> into the anterior tubercles of transverse processes of 5th & 6th cervical vertebrae. (c) <u>Middle vertical part:</u> into bodies of 2, 3, 4 cervical vertebrae.	1. Whole muscle flexes the neck. 2. Oblique parts flex the neck laterally. 3. Lower oblique part rotates neck to opposite side.
(3) <u>Longus capitis.</u> Overlaps longus colli; thick above and narrow below.	Anterior tubercles of transverse processes of 3-6 cervical vertebrae. (similar to scalenus anterior).	Inferior surface of basilar part of occipital bone.	Flexes head.



* Nerve Supply of prevertebral muscles : all are supplied by ventral rami of cervical nerves.

VERTEBRAL VEIN

* Beginning : it begins in the suboccipital triangle.

* Course & relations :

(1) it descends in the form of plexus of veins around the 2nd part of the vertebral a. in the foramina transversaria of the upper 6 cervical vertebrae.

(2) it emerges from the f. transversarium of C6 as a single vein which descends in front of the 1st part of the vertebral a. in the vertebral triangle.

* termination : it ends by opening into the the corresponding innominate vein.

* Communications : (1) with the sigmoid sinus (via the post. condylar emissary vein).

(2) with occipital vv. (3) with internal vertebral venous plexus (inside verteb. canal).

II-- PARATHYROID GLANDS

* These are 2 pairs (2 sup. & 2 inf.) of small endocrine glands embedded in the post. aspect of the 2 lobes of the thyroid gland. Each one has the shape & size of a split pea (6mm. long & 3 mm. wide).

* the sup. parath. lies at the middle of the post. surface of thyroid while the inf. lies near the base of thyroid gland.

* blood Supply : branches of inf. thyroid artery.

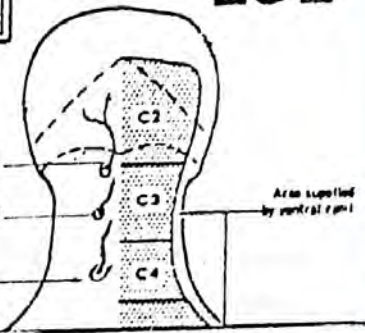
III- BACK OF THE NECK

191

I-Skin: very thick & is supplied by the med. branches of the dorsal rami of: C₂ (greater occipital n.)

C₃ (third occipital n.)

C₄



II-Muscles: the important muscles can be grouped into 4 layers arranged as follows (from superficial to deep):

1st layer	2nd layer	3rd layer	4th layer
1-Sternomastoid (see H&N. page 104) 2-Trapezius (see U.L. page 38)	(1) Levator Scapulae. (see U.L. page 40). (2) Splenius muscle (see below).	(1) semispinalis capitis (2) longissimus » (see page 192)	the 4 suboccipital muscles: (1) rectus capitis post. major (2) » » » minor (3) Superior oblique (4) inferior oblique

* Splenius muscle:

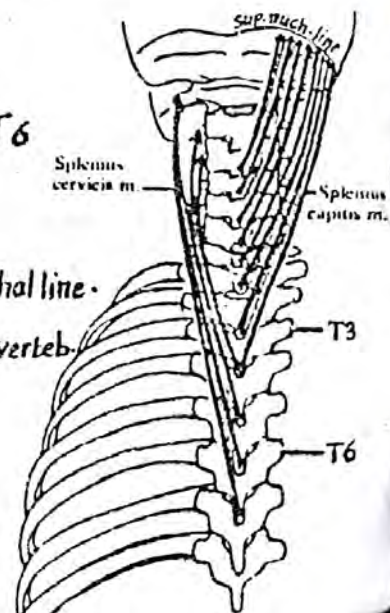
- **Origin**: lower part of nuchal lig. & vertebral spines from C₇ to T₆

- **Course**: it passes upwards & laterally dividing into 2 parts:
(a) splenius capitis (b) splenius cervicis.

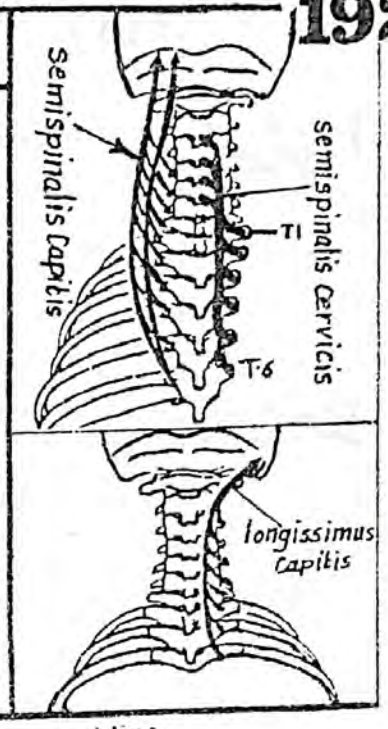
- **Insertion**: (a) splenius capitis: into mastoid pr. & lat. part of sup. nuchal line.
(b) » Cervicis: into tr. processes of upper 2-3 cervical verteb.

- **N. Supply**: dorsal rami of cervical nerves.

- **Action**: (1) bends the head & neck backwards.
(2) rotates the face towards its own side.



Muscle	origin	insertion	n. supply
<u>Semispinalis Capitis</u> (deep to splenius Capitis)	- articular processes of C4 → C6 - tr. processes of C7 → T7	into the med. area between the sup. & inf. nuchal lines	Post. 11y rami of Cervical & upper thoracic m.
<u>Semispinalis Cervicis</u> (deep to semispinalis Capitis)	Tr. processes of the Th. vertebrae 1 → 6	spines of the Cervical vertebrae 2 → 5	
<u>Longissimus Capitis</u> (lat. to semispinalis Capitis).	- tr. processes of T1 → T5 - articular processes of C5 → C7	post. margin of the mastoid process.	



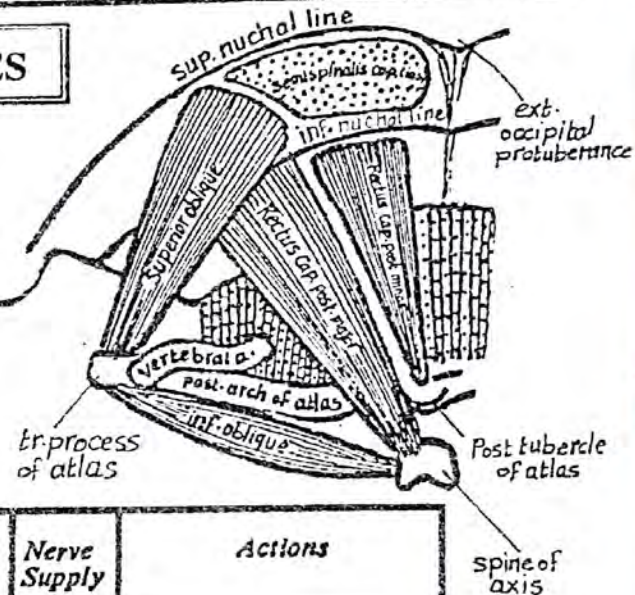
semispinalis cervicis

semispinalis capitis

longissimus capitis

SUBOCCIPITAL MUSCLES

- * they are 4 short muscles which lie below the occipital bone forming the boundaries of the suboccipital triangle. They include:
- (1) the obliquus capitis sup. (sup. oblique m.)
 - (2) " " " inf. (inf. oblique m.)
 - (3) rectus capitis post. major m.
 - (4) " " " minor m.



Muscle	Origin	Insertion	Nerve Supply	Actions
1. <u>Rectus capitis posterior major</u>	Spine of axis	Lateral part of the area below inferior nuchal line.	Suboccipital n. (dorsal ramus of C1)	1. Mainly postural. 2. Turns the face to same side (single muscle). 3. Extend the head (both muscles).
2. <u>Rectus capitis posterior minor</u>	Posterior tubercle of atlas	Medial part of the area below inferior nuchal line.		1. Mainly postural. 2. Extend the head.
3. <u>Obliquus capitis superior (superior oblique)</u>	Transverse process of atlas.	Lateral area between the nuchal lines.		1. Mainly postural. 2. Extend the head. 3. Laterally flex (bend the head).
4. <u>Obliquus capitis inferior (inferior oblique)</u>	Spine of axis	Transverse process of atlas.		1. Mainly postural. 2. Turns face to the same side.

III - Blood Vessels in the back of neck :

193

- (1) deep cervical a. (br. of costocervical trunk) : described in page 125.
- (2) 3rd part of vertebral artery : " " " 124.
- (3) descending br. of occipital artery : " " " 134.
- (4) Suboccipital plexus of veins:

- Site: it is a network of veins lying in & around the suboccipital Δ .
- Communications: the plexus communicates with :
 - (1) occipital veins
 - (2) internal vertebral plexus of veins.
 - (3) sigmoid sinus (via post-condylar emissary v.).
- drainage: the plexus drains into the vertebral venous plexus around verteb.-a.

IV - Nerves in the back of neck :

- the skin & muscles of the back are supplied by the dorsal rami of the cervical nerves :

* Dorsal ramus of C₁ (suboccipital nerve):

- emerges between the post. arch of atlas (below) & the vertebral a. (above) to enter the suboccipital Δ .
- it supplies the 4 suboccipital muscles.

* Dorsal ramus of C₂ (greater occipital nerve)

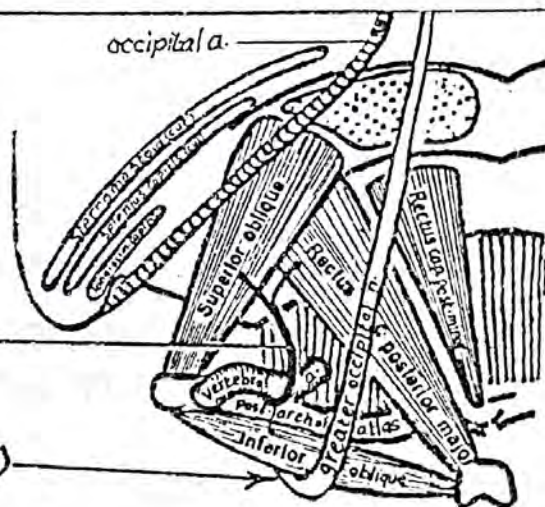
- it is the thickest of all cervical dorsal rami.
- it emerges between the dorsal arch of atlas & lamina of the axis vertebra.
- it curves round the lower border of inf. oblique m. then crosses the suboccipital Δ .
- it pierces the semispinalis capitis & trapezius about 1" lat. to the ext. occip. protuberance.
- it supplies muscular brs. to semispinalis capitis & splenius m. & cutaneous brs. to the back of the scalp.

- * Dorsal ramus of C₃: pierces the splenius & trapezius muscles to reach the skin. It supplies muscles & skin of the back of neck & gives a br. called 3rd occipital n. which ascends med. to the greater occipital n. to supply skin of the back of scalp.

N.B: (1) each dorsal ramus of the cervical nerves (except the 1st) divides into: (a) lat. br. (motor) & (b) med. br. (motor & sensory). The dorsal ramus of C₁ does not divide & is motor.
(2) the dorsal rami supply all muscles of the back of neck except trapezius & lev. scapulae.

Ligamentum nuchae

- * It is a triangular strong fibrous median septum stretching between the muscles of both sides of the back of the neck.
- * Its base is attached above to the ext. occipital protuberance & ext. occipital crest.
- * its post. border is free while its ant. border is attached to the spines of the cervical vertebrae.



* Site: inside the petrous temporal bone.

* Structure: it consists of 2 parts:

(1) bony labyrinth: bony cavities inside the petrous temporal bone.

(2) membranous labyrinth: interconnected sacs & ducts inside the bony labyrinth.

A- BONY LABYRINTH

consists of 3 parts (semicircular canals, vestibule & cochlea) which are lined by endothelium & filled with perilymph & enclosing the membranous labyrinth.

I-Semicircular canals: are 3 arched canals set at right angles to each other forming the postero-superior part of the bony labyrinth.

(1) the superior semicircular canal

lies in a vertical plane at right angle to the petrous temp. bone

(2) the posterior semicircular canal

lies also in a vertical plane but parallel to the post. surface of the petrous temporal bone.

(3) the lateral semicircular canal

lies in a horizontal plane & convex laterally.

* These 3 canals open in the post. aspect of the vestibule by 5 orifices (one is common to 2 canals).

II-The Vestibule: is the central part of bony labyrinth

- its lat. wall is related to the middle ear & shows oval window which is closed by the foot of stapes.

- its ant. wall shows the opening of the scala vestibuli of the cochlea.

- its post. wall receives the openings of the 3 semicircular canals.

- its med. wall forms the bottom of the int. auditory meatus & is perforated by the 8th n.

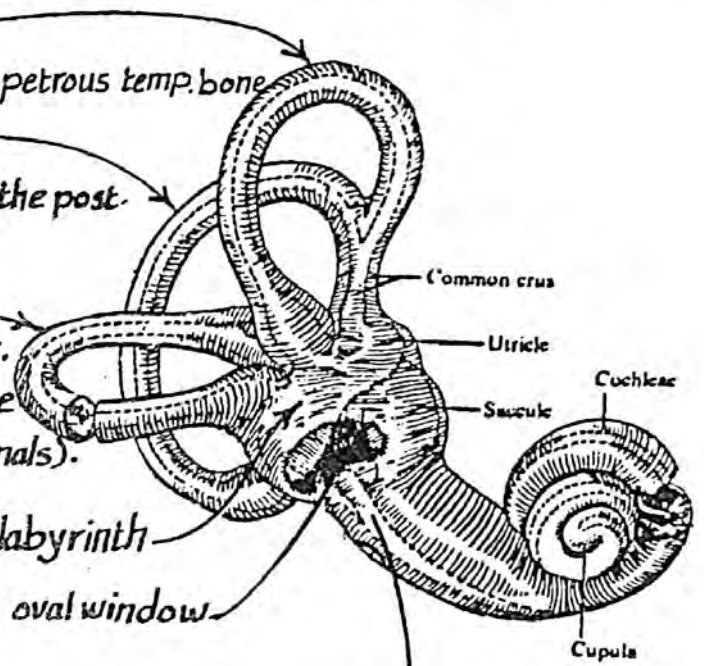
- the vestibule lodges the utricle & saccule which are parts of the memb. labyrinth.

III-The Cochlea: is the ant. part of the bony labyrinth:

- it resembles the shell of a common snail forming $2\frac{1}{2}$ turns around its axis (modiolus).

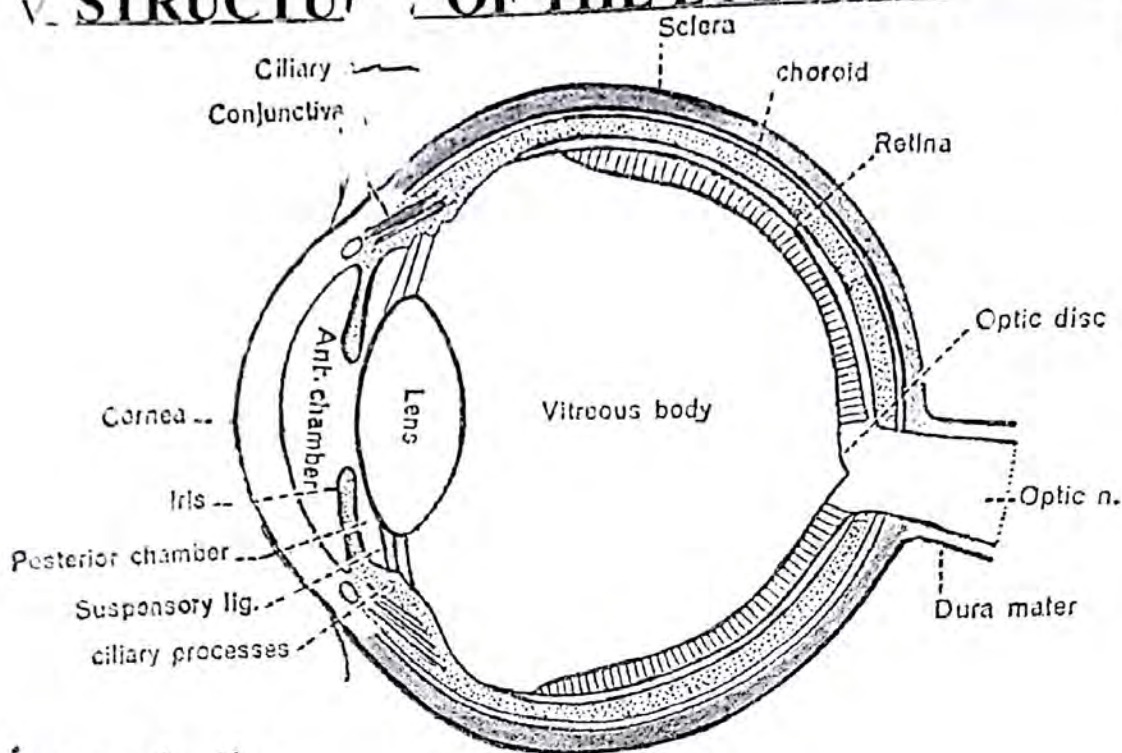
- its base is directed medially towards the bottom of the int. auditory meatus & is perforated by the fibres of the cochlear n. Its apex is directed laterally & called cupula.

- the cochlear canal lodges the cochlear duct of the membranous labyrinth.



V. STRUCTURE OF THE EYE BALL

196



Sagittal section of the eyeball.

(A) Wall of the eye ball :

is formed of the following 3 coats :

(1) outer fibrous coat which consists of :
 (a) Cornea : the ant. transparent part
 (b) Sclera : the the dense white part.

(2) Middle vascular coat which includes :

(a) choroid : a black vascular membrane deep to the sclera.

(b) Ciliary body : is continuous with the ant. part of the choroid & contains the ciliary m. (unstriated) which is attached to the suspensory ligaments of the lens & is the main muscle for accommodation.

(c) iris : is the ant. part of the middle coat lying between the cornea & the lens.

It has an opening in its centre called the pupil & contains circular m. fibres called sphincter pupillae & radial m. fibres called dilator pupillae.

(3) Inner Nervous coat : the retina.

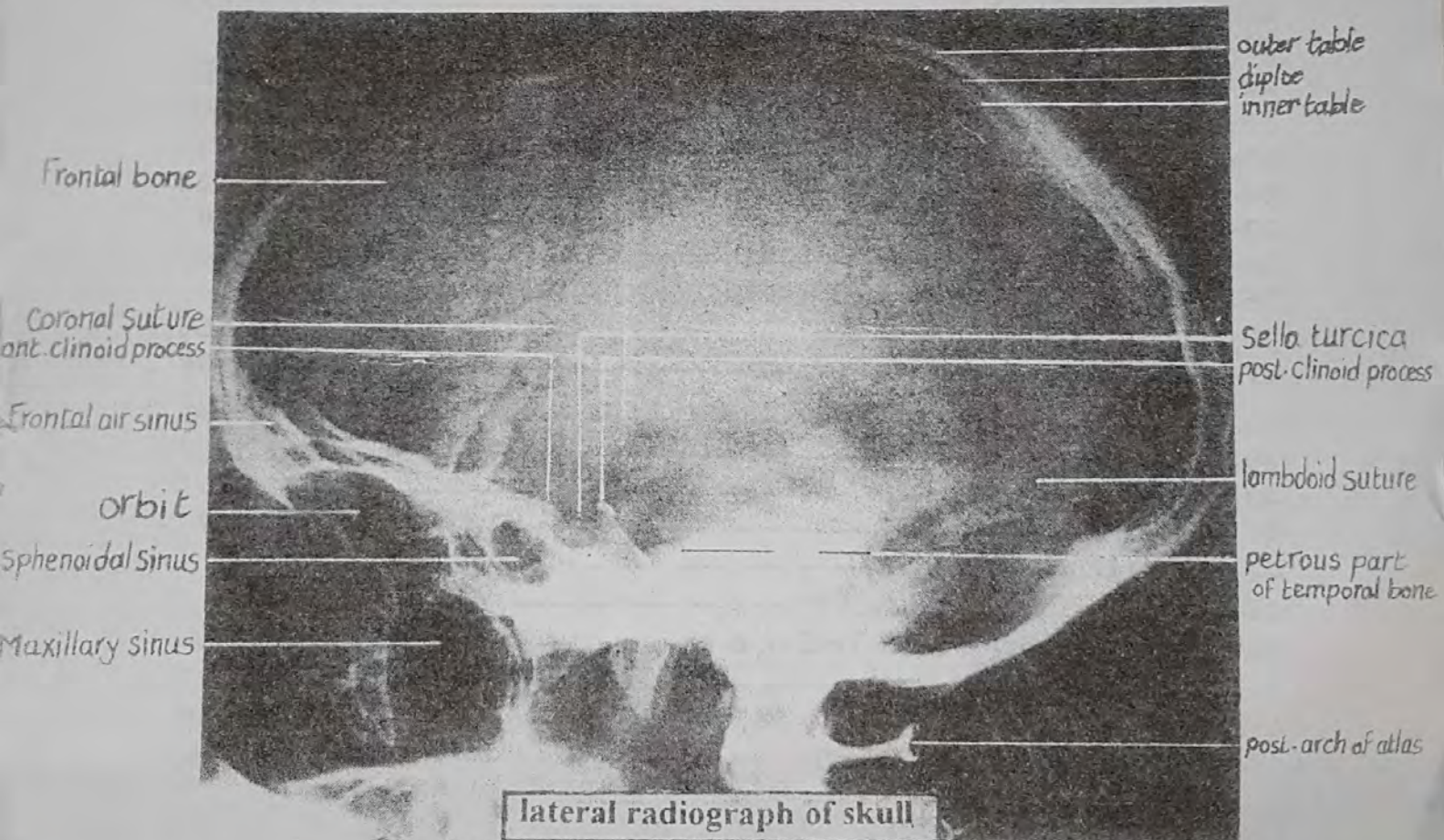
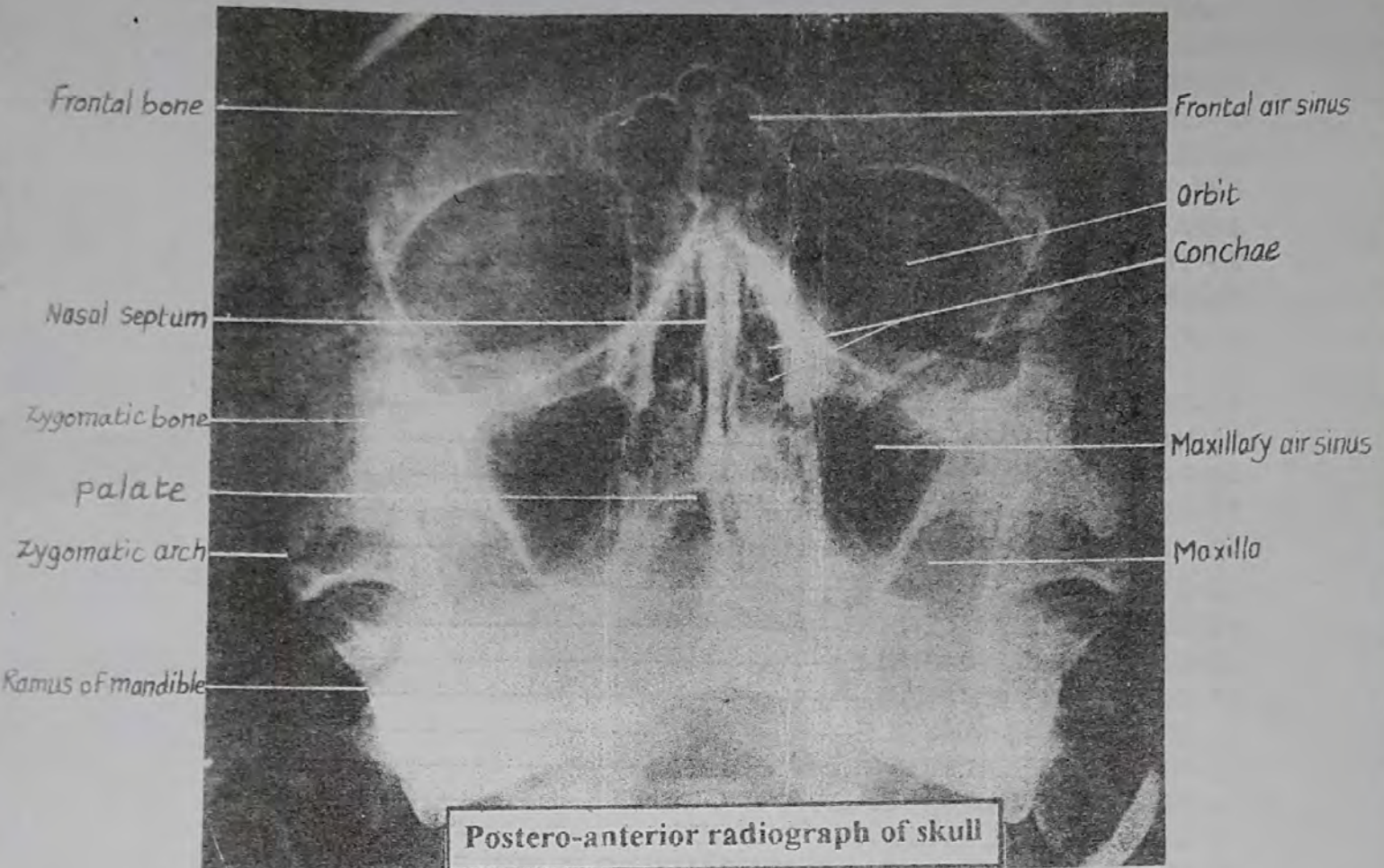
(B) Cavity of the eye ball : contains the following :

(1) Aqueous humour : is the clear fluid filling the space between the cornea & the lens.

This space is divided by the iris into ant. chamber & post. chamber.

(2) the vitreous body : a jelly like transparent substance which fills the post 4/5 of the eye ball & is enveloped by hyaloid membrane.

(3) the lens : is a biconvex transparent structure lying between the aqueous humour & the vitreous body. It is surrounded by a capsule to which is attached the suspensory ligaments of the ciliary body.



INDEX OF CONTENTS

	<u>Page</u>
1.SKULL-----	1-30
2-MANDIBLE-----	31-36
3-SCALP-----	37-42
4-FACE-----	42-49
5-TEMPORAL & INFRATEMPORAL FOSSAE-----	50-53
6-MANDIBULAR N., OTIC & SUBMANDIBULAR GANGLION-----	53-58
7-MAXILLARY & SPHENOPALATINE GANGLION-----	59-61
8-MAXILLARY A.-----	62-64
9-PTERYGOID PLEXUS OF VEINS-----	65
10-EMISSARY VEINS-----	66
11-PAROTID GLAND-----	67-72
12-CRANIAL CAVITY-----	73-82
13-ORBIT-----	83-93
14-NASAL CAVITY-----	94-96
15-PARANASAL SINUSES-----	97
16-NECK(SUPERFICIAL & DEEP FASCIA)-----	98-102
17-ANTERIOR TRIANGLE OF NECK-----	103
18-STERNOMASTOID-----	104-105
19-SCALENUS ANTERIOR-----	105-106
20-DIGASTRIC TRIANGLE-----	107
21-DIGASTRIC MUSCLE-----	108-109
22-MYLOHYOID MUSCLE-----	109-110
23-HYOGLOSSUS MUSCLE-----	111
24-SUBMANDIBULAR SALIVARY GLAND-----	112-113
25-SUBLINGUAL SALIVARY GLAND-----	114
26-MUSCULAR TRIANGLE & INFRAHYOID MUSCLES-----	115-116
27-THYROID GLAND-----	117-119
28-CAROTID & SUBMENTAL TRIANGLES-----	120
29-SUBCLAVIAN ARTERY-----	121-125
30-C.C.A-----	126-127
31-I.C.A-----	128-130
32-E.C.A-----	131-134
33-VEINS OF THE NECK-----	135-136
34-NERVES OF THE H & N-----	137-150
35-POST. TRIANGLE OF NECK & SUBOCCIPITAL ▲-----	151-153
36-PHARYNX-----	154-158
37-LARYNX-----	159-164
38-TONGUE-----	165-166
39-SOFT PALATE-----	168-169
40-EAR-----	170-175
41-STYLOID APPARATUS-----	176-177
42-HYOID BONE-----	178
43-MEDIAN REGION OF NECK-----	179
44-LYMPH DRAINAGE OF THE H. & N-----	180-184
45-JOINTS OF THE H & N-----	185-187
46-CERVICAL VERTEBRAE-----	188-189
47-SUPPLEMENTARY NOTES-----	190-195

